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Contents

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Event and Comment.

Rural Rubber Requirements—the Supply Position.

TO satisfy the needs of primary producers particularly, special efforts are being made to ease the position arising from the shortage of rubber tyres and tubes, according to advices received from the Ministry of Supply and Shipping. Because of war conditions, the crude rubber shortage is general, and what is available is obviously reserved for the priority needs of the Allied Forces. Although synthetic rubber production in the United States is proceeding steadily, American manufacturers have not reached the stage at which all types of tyres can be made predominantly of synthetic materials. It is still necessary to use a proportion of crude plantation rubber in most of the larger tyre sizes, which make up the bulk of present-day production, consequently stocks must continue to be drawn on until such time as the production of tyres solely from synthetic rubber becomes practicable on an appreciable scale. The following statement was recently issued in London by the Combined Raw Materials Board and published in the *Financial Times*:—

> "The considerable progress achieved in America's synthetic rubber programme has led to a certain lack of appreciation concerning the United Nations' need for natural rubber. Since this misunderstanding threatens to hamper the United Nations in securing the largest possible amount of natural rubber from the few producing areas still under our control, the Board wishes to emphasise in the strongest possible terms our urgent need for crude rubber.

"Very careful estimates have been made of the quantities and types of tyres and rubber products required to be produced for military and essential civilian use during the coming year. Authorities both in the U.K. and U.S. are reducing to a minimum the amounts of natural rubber which manufacturers will be permitted to use in meeting this programme.

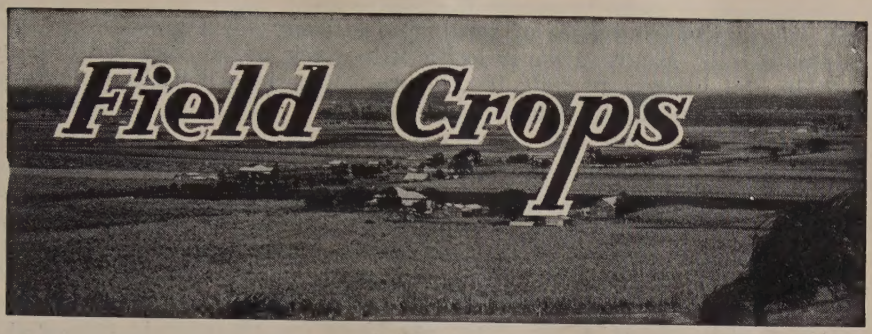
"None the less, the amount of rubber which must be released if essential needs are to be met will dangerously deplete natural rubber reserves and leave the stock position of the United Nations at the end of the year at below the minimum hitherto regarded as necessary. The situation in 1945 will be further aggravated unless more natural rubber than is now in sight is forthcoming."

The foregoing demonstrates the necessity of the present rigid control of distribution of the limited quantities of tyres which can be made available for essential civilian purposes. All applications for tyres are closely examined, but despite this and the close examination of the whole problem of making sufficient tyres available for the maintenance of civilian transport, it is clear that it is impossible at the present time to re-equip a large number of motor vehicles. For this reason, the Commonwealth Department of Transport, through the State Directorates of Emergency Road Transport, which operate in the closest collaboration with the rubber control sections of the Ministry of Supply and Shipping in the several States, has had to progressively apply a policy of transport rationalisation.

The Ministry of Supply and Shipping is fully impressed with the fact that the maintenance in full production of foodstuffs projects is of the highest importance. The supply position of tyres for primary producers is under constant review, and every effort is being made to find ways and means of allocating a greater quantity to meet their essential needs. Where efforts have succeeded no time has been lost in easing the situation to the greatest possible extent.

The tyre position in Queensland has received particular attention for several months past. Since last December, the basic quota for motor and utility car tyres for this State, which was determined on a strictly equitable basis in relation to the quotas for other States, has been progressively increased by special allocation to the extent of 127 per cent. for the four-month period ended 30th April last. In the main, these special allocations have been distributed to primary producers. Because of war conditions, tyre manufacture is restricted to a limited range of standard sizes; tyres not included in this range are extremely difficult to replace.

It will be appreciated generally that, in existing circumstances, difficulties in meeting all deserving claims will continue. Primary producers are among the largest and most important sections of essential users, and their co-operation in the wide adoption of community carting is necessary if delays in transportation are to be avoided. Preference in tyre supply is given to isolated farms where co-operative carting is not practicable. There are, of course, many degrees of essentiality, but very close watch is being kept on the whole position, and every effort is being made to maintain the transport systems of the farming and grazing industries and extend to them as much relief as can possibly be afforded. Moreover, facilities of repairing and re-treading plants are being increased, as far as practicable, throughout the Commonwealth.



Potato Production in North Queensland.

T. G. GRAHAM, Instructor in Agriculture.

POTATO growing in North Queensland on an appreciable scale dates back about thirty years. Expansion proceeded slowly until two years ago when the increase in production became rapid, as a result chiefly of improved cultural methods and a more extensive use of fertilizer.

In the early days of potato development in the North, low yields and the incidence of potato tuber moth were retarding factors. The northern crop is grown almost entirely under irrigation, and matures during winter. Spring crops may be grown on the Atherton Tableland under natural rainfall conditions, but yields are not very reliable, and little expansion has taken place there. Most of the northern potato crop therefore is grown between Mackay and Ingham, with by far the greatest production in the Burdekin Delta.

Soil Requirements.

For the potato the range of soil requirements is wide, but friable, well-drained, fertile loams give best results. Growers are referred to the *Queensland Agricultural Journal,* Volume 57, Part 1, July, 1943, and to the *Queensland Agricultural and Pastoral Handbook* (Volume 1), in which many aspects of potato production are dealt with fully. This article deals more specifically with the irrigation aspect, particularly in respect of North Queensland conditions.

Preparation of Soil.

The primary objects in preparing a seed bed for potatoes are:—

(1) To kill weeds.

(2) To pulverize the soil to form a mellow seed bed.

It is impossible to produce maximum yields from badly prepared land. The object, therefore, is to plough in a green manure crop at a depth of from 10 to 12 inches if practicable, in late February or early March to enable the legume to rot away, and the soil to mellow down during the rainy period of March. Attention should be given to the time of ploughing, and care should be taken as far as practicable to ensure that the optimum period of soil moisture is reached before ploughing commences. Soils ploughed when too wet or too dry loose their physical condition, and the valuable crumb-like structure is destroyed. A second ploughing about six inches deep should be given

just sufficiently in advance of seeding to kill any weed growth, and to aerate the soil. A cultivation is desirable to check any weeds immediately preceding planting, especially if rain has fallen since ploughing, but in any case to even off the field.

Seed.

Growers in North Queensland are at a disadvantage since they are unable to save their own seed. They are dependent entirely on the quality of the seed material sent from southern States. Cutting the sets is not practised as a general rule, since the risk involved is considered to be too great. Because of this, it is most desirable that the seed for the northern crop be specially selected as to size, in order that the planting rate may be kept at a minimum. None other than treated, certified seed should be used.

Many farmers take too little care with their seed. All potatoes should be well forward before planting. Uniformity of the crop cannot be obtained otherwise; but generally, consignments of seed have commenced to move at the time of taking delivery. When potatoes commence to shoot, they should be removed from the bags, all damaged and diseased tubers rejected, and the sound potatoes spread out to a depth not exceeding three inches, in a cool, dry, shady place. Crates are by far the best storage containers, but as yet are not used in the North. This process is called "greening," and its object is to form strong green shoots with many nodes. Seed shot in bags will quickly develop long slender white shoots with a few nodes. These shoots, moreover, are easily damaged, and a large proportion are rubbed off in handling. The importance of greening, apart from aspects already pointed out, will readily be apparent when it is remembered that stolons form from the nodes of the underground stem. The more nodes therefore in a unit length of stem, the greater the potential yield of tubers. Compare, for example, the short green shoot of a greened potato with that of a long white spindly shoot from a tuber which has been allowed to remain in a dark, badly ventilated place too long. Seed potatoes stored in crates require far less handling than those stored in a loose heap, as they may be planted out directly from the crates.

Varieties.

Two main varieties are grown in North Queensland, namely, Brownell and Bismarck. These varieties are well suited to the conditions, they comprise the main source of available seed at the appropriate time of the year, and they have shown a marked resistance to disease. Many other varieties have been tried from time to time, but until recently no detailed experiments have been carried out. Katahdin, a late maturing variety resistant to mosaic, has given good results in the southern States and is showing great promise in the North. Growers should refrain from planting new varieties in any quantity until careful observations have been made, and their value clearly demonstrated.

Fertilizer.

Fertilizer trials have been conducted by the Department of Agriculture and Stock over a period of years, and the results indicate an improvement in grade and yield. The best results to date have been obtained by the application of a mixture of sulphate of ammonia and superphosphate in equal proportions, at the rate of from 4 cwt. to 7 cwt. per acre. Applications of heavier than 3½ cwt. of sulphate of

ammonia in a fertilizer mixture had a detrimental effect on germination. This has been due to tubers coming in direct contact with the fertilizer, since in all the trials the fertilizer was spread along the bottom of the drill just before planting. Larger quantities could, no doubt, be applied with advantage if the fertilizer were kept from direct contact with the sets. According to American opinion, the placement of the fertilizer has an important bearing on early growth and ultimate yield. Best results have been obtained where fertilizer has been placed on either side of the drill about two inches from and slightly below the level of the seed. Observations in the Burdekin Delta tend to confirm this. This method also ensures a loose layer of soil below the seed. Fertilizer machines which traverse the row are available in the canegrowing areas, and if they do not place the fertilizer in bands, they may be easily altered to do so. Potato-planting machines have the necessary fertilizer distributing attachments.

Sulphate of ammonia is necessary to promote growth, while superphosphate tends to even up the crop and induce early maturity. Dried blood, at the rate of 5 cwt. to the acre, has given good results on some soils, but the resultant crop has a tendency to be more uneven.

For best results fertilizer should be applied at the time of planting

Planting.

The best method of planting potatoes is to open up furrows by means of a drill plough, the required distance apart, place the tubers by hand, and cover by splitting the interspace between the drills. This leaves the potatoes in ridges, with ample drainage assured should heavy rain fall. Mechanical planters do an excellent job, but a more even stand is obtained by hand planting. Ploughing-in is sometimes adopted, but the method is rarely used in the North. Planting should follow soon after the application of fertilizer. It is advisable not to open up too many furrows in advance, and to close them again as soon as possible after seeding. The aim should be to avoid loss of soil moisture in the process.

The chief consideration determining the distance between rows, and the distance apart of sets, is the fertility of the soil, and the amount of available soil moisture. In dry land potato production, the spacings are wider, and the amount of seed planted is much less than with irrigated crops. Under irrigation, row spacing varies somewhat, but usually, as a matter of convenience in cultivating, ditching, irrigating, and digging, the rows are spaced from 39 to 42 inches, and the seed pieces are planted from 10 to 15 inches apart, depending on variety, and fertility of the soil. Wide ridges are important in irrigated districts, as they give ample room for tuber development and provide sufficient soil for hilling against tuber moth infestation. Under irrigation close spacing within the rows has been found necessary with some varieties to reduce the size, to minimise growth cracks and hollow heart, and to secure maximum yields. The tendency to produce "bolters" is far less when close spacing has been practised, and the experience in experimental trials, is that a uniform crop is produced when the spacing is 12 inches. With this spacing and the fertilizer application as recommended, very few unsaleable potatoes have been observed.

Cultivation.

Harrowing as a practice before the plants emerge from the soil, is growing in favour. It has the advantage of killing early weeds, breaking any crust that may form, and smoothing out the ridges left by the drill plough. Should weeds become troublesome, with the customary methods of planting, the rows can be followed before the plants are up. To cultivate rather deeply after planting is a good practice. A week later, it is advisable to go over the field lengthwise with a set of harrows, to level the ridges and check weed growth. If necessary, this harrowing should be followed again by a lighter harrowing in the same direction. Thoroughness in this operation will save much time and labour later on, for weeds are killed much more easily in the seedling stage than after having become firmly established. About the fifth week from planting, the time for the first watering should be drawing near. In preparation for this, the best practice is to run the scuffler down between the rows, with the object of killing weeds, and loosening the soil. This should then be followed by the drill plough, or butterfly, or tractor hilling attachments, throwing the earth up lightly towards the plants, forming a water furrow.

The number of cultivations vary with conditions; the purpose is to kill weeds, to aid surface absorption of water by keeping the surface friable, and to provide a hill which prevents moth attack. Since weeds remove plant food and moisture, they must be thoroughly controlled. If weeds get a good start early in the season, the job of keeping them in check becomes well nigh impossible. As soon as practicable after the first watering, cultivate as deeply as possible, setting the outside shovels slightly shallower to throw a little soil into the rows. See that this cultivation loosens up the soil thoroughly. Potato roots grow near the surface, so late cultivations should be more and more near the surface to avoid root pruning. When the plants cover half the row, set the cultivators narrower, and do not run them deeper than 2 or 3 inches. Drilling should immediately follow cultivation in order to throw a loose layer of crumbly moist soil up to the plants; the land is thus ready for watering as soon as it is deemed necessary to irrigate again. As a general rule, hilling should follow each watering. Where irrigation is practised, the ill effects of hilling by loss of moisture, are counterbalanced, and the grower is thus able to direct his energies along the lines of hilling to prevent tuber moth attack.

As soon as practicable after the last watering is given, approximately two weeks from harvesting, a final complete hilling should be given. This may be done with two 20-inch discs attached to a specially constructed frame of simple design, which throw up furrow slices which meet over the tops of the haulms, and fall as a curtain over the stems, thus affording protection against an attack of tuber moth. The danger of tuber moth attack increases as the season advances, but the risk increases enormously during the last three weeks of the life of the crop. It is during this period that the grower has to exercise the greatest care.

The type of hill is important. The object should be to make the earth on each side of the plants meet in the centre, thus forming a peak, and not have a space along the row of plants where the soil has not met. Many farmers imagine they have done an effective hilling job, when on closer examination the top of the hill is found to be formed in the shape of a V, which means that the earth has not been pushed up far

enough. Special care in doing this is necessary from the second hilling onwards.

Watering.

The aim of the irrigator should be to keep the plants in active growth. From the time the first watering is given until the last, the plants should never be allowed to suffer from the lack of moisture, since the production of maximum yields, and the quality of the crop grown under irrigation depends largely on the proper application and use of water. The quality of the crop is not injured by water if wisely and properly used. Light and often should be the maximum.

When furrow irrigation is to be practised, furrows should be made before the water is applied. The method by which these are formed has already been described. The type of furrow to be made depends on the type of soil, and the slope of the land. On flat land with heavy soils, the furrows should be deep and broad so that the water will not reach the top of the ridge, but may be forced quickly to the far end of the rows. If the land is steep or of a type which will wash badly, a small furrow should be used.

In some areas three or four applications of water will be enough, while in others five or six or even more may be given with advantage. Because of the variations in the water-holding capacity of different soils, and the influence of temperature, rainfall, and other seasonal conditions, it is impossible to prescribe a time when the first watering should be applied, the number of irrigations, and when the last watering should be given, but it is believed that the following general rules should be observed:—Apply first water when plants appear to require it to maintain maximum growth. If the seed bed were sufficiently moist at the time of planting it should not be necessary to water until the fifth week after planting. Once having applied the water, it is imperative that the soil should be kept moist by light or medium light waterings until a few weeks from harvesting. The farmer, with his own local knowledge, should master the frequency with which his particular field should be watered. The period varies between every ten to sixteen days, seldom longer. The ideal condition is to have all the soil, except the top of the ridge, continuously moist.

The adequacy of moisture in the soil may be determined by an examination of the soil 8 to 10 inches beneath the top of the ridge, by the condition of the plants, and by the colour of the foliage. Plants supplied with proper moisture should look vigorous, and have foliage colour typical of the variety. Lack of moisture in the soil causes the plants to wilt in the heat of the day, and they become dark and harsh; while an over supply of moisture causes the plants to assume a lighter colour than is normal for the variety.

Frequent light waterings of approximately 2 inches per watering are preferable to heavy waterings of 4 or 5 inches. If the overhead spray system is used the aim should be to give the plants a 2-inch watering at each application.

When furrows are used, the length of run is governed by the type of soil. It is a disadvantage to have water furrows more than 6 chains long, unless the lay of the land suggests an even watering at a greater length. The main thing to avoid is over watering one end in order to get sufficient water to the other.

Harvesting.

Potatoes should not be dug until the crop has come to maturity. Immature tubers scar easily, and unless handled very carefully make a poor appearance on the market.

When maturity is approaching—usually determined by yellowing and the drying off of foliage, about 13 weeks from planting—tests may be made periodically for ripeness. Usually, if the skin of the potato slips under pressure of the thumb maturity has not been reached. It is advisable not to delay harvesting after the potatoes have reached maturity, because of the prevalence of tuber moth. On the other hand, if potatoes are harvested too soon, apart from the appearance aspect already referred to, the maximum yield has not been obtained, since the greatest development takes place in the tubers during the last three weeks of growth. Harvesting should be completed when once commenced, with a minimum of delay, avoiding digging in fits and starts.

Mechanical diggers are usually used on large areas. These diggers lift the potatoes over the carrier chain, the process separating the tubers from the soil. Drill ploughs and vibrator diggers also are used. Care is required, however, in the adjustment of mechanical diggers to avoid injury. Tubers injured at time of harvest are likely to be attacked by dry rot or wet rot in storage.

In North Queensland potatoes should be picked up immediately after they are dug; otherwise, apart from the risk of tuber moth infestation, serious loss through scalding is likely to occur if the weather is warm. The great danger is that the injury is not usually apparent at the time, but shows up after they have been bagged for some hours. The process of decay then proceeds very rapidly, so that within a day or so a very large percentage of the bag will become a foul-smelling rotten mass.

Growers should grade carefully and avoid placing injured or affected potatoes in bags with sound potatoes. When full, the bags should be stitched at once, up-ended in the field, and the soil cast up around the stitched end. This forms a seal against moths. Potatoes should be removed from the field as soon as practicable.

More Power to the Land.

DEMONSTRATION OF MODERN FARM MACHINERY.

TO Mr. W. McCabe's farm at Bethania on 17th May came 500 information-seeking farmers from many parts of Queensland—from the Atherton Tableland and the coastal country around Cairns to the Granite Belt on the southern border and districts in between—to see for themselves modern farm machinery in action in the field.

The well-organised demonstration was arranged by the International Harvester Company, who had a team of experts in the field under the general direction of the manager for Queensland, Mr. Athol Blair. Of American design, much of the machinery was the output of the company's plant at Geelong, Victoria, and the product of skilled Australian workmanship. Watching the new machines at work, the dominant thought was that the engineer not only puts his skill and ability into adding to the national food supply, but enriches

agriculture by reducing manual work and improving the quality and distribution of the harvest. The agricultural engineer has surely demonstrated that the hard work of food production depends no longer entirely on the muscles of men and draught animals.

Plate 147.

GROUPS OF INTERESTED FARMERS GATHERED ROUND THE DEMONSTRATORS WHO EXPLAINED THE WORKS AND THE WAYS OF MODERN FARM MACHINERY.

Linked appropriately with the nation-wide food production campaign, the field-day demonstration was of particular importance to farmers who have commenced vegetable growing on a large scale, and also to vegetable growers working small areas, to whom the new machinery may have an appeal if it is distributed through local co-operative farm machinery pools. Seen in action, both as single units and in combined operation, were three types of tractor-drawn ploughs, tandem disc harrows, four-row seed planters, four-row carrot-, bean- and maize-cultivating outfits, and a mower attachment to a tractor doing a fast and clean job in a standing crop of sudan grass.

Plate 148.

A DEMONSTRATION OF EFFECTIVE PLOUGHING IN QUICK TIME.

The scene of operations was a rich stretch of alluvial land along a bank of the Logan River. The pioneers of these fertile acres had voyaged up the river by sailing cutter on the full run of the tide from Moreton Bay on a day back in 1864. Among the onlookers were descendants of those pioneers, still farming the land won from the jungle by their forbears 80 years ago.

Plate 149.

TRACTOR WITH 4-ROW VEGETABLE CULTIVATION ATTACHMENTS.

The new machinery included a modern "Farmall" tractor, a great all-purpose power unit, speedy and capable of turning within its own length, and to which may be fitted attachments for the preparation of the finest seed bed, sowing of the tiniest of seeds, clean cultivation of the smallest of row plantings and harvesting of the resultant crops. By the use of such equipment many more thousands of acres have already been brought under vegetable production at a period when time, as the

Plate 150.

NEW DEVELOPMENTS IN WEED CONTROL.—Farmers interested in new methods of crop protection as explained by Mr. C. W. Winders of the Department of Agriculture and Stock.

essence of the contract, has never been so significant. The "Farmall" is no ordinary tractor. It has a body shaped like a stream-lined belly petrol tank, set on a pair of high, massive rubber-tyred wheels with low-set twin wheels in front, and can be put to work at various speeds up to 16 m.p.h. Although designed primarily to serve wartime needs, the future of this new tractor-operated machinery on Australian farms is assured.

Plate 151.

A 2-ROW CULTIVATOR ATTACHMENT ADAPTABLE TO POTATO, TOMATO, AND OTHER ROW CROPS.

Generally the field-day demonstration at Bethania provided striking evidence of progress in agricultural engineering which, in combination with agricultural science, will ensure that the nation shall not starve. Associated with the machinery men were science men from the Department of Agriculture and Stock, who told each group of interested farmers how to protect their crops from pest and disease attacks between seed-time and harvest. So, apart from its primary

Plate 152.

MOWER ATTACHMENT TO A "FARMALL H" TRACTOR, WHICH CUT CLEANLY AND EFFECTIVELY THROUGH A STANDING CROP OF SUDAN GRASS.

purpose, the day's proceedings showed that with the farmer, the engineer and the man of science may also be regarded as producers of food and, therefore, among the most essential of the nation's workers. They are the production men who have organised the facts of nature into a power which multiplies the muscles of man in mankind's service and survival. They have, with the farmer, the answer to the age-old problem of feeding the hungry.

Plate 153.

A GENERAL EXCHANGE OF VIEWS AND OPINIONS ENDED THE DAY'S PROCEEDINGS.

From a practical point of view the Bethania machinery field day was highly successful. From a social point of view it was equally so, for the Beenleigh Red Cross workers and Country Women's Association saw to that in their traditional way and with their traditional hospitality.

Plate 154.

PEST AND DISEASE CONTROL.—New measures and methods were explained to successive groups of interested farmers by Mr. J. A. Weddell, of the Department of Agriculture and Stock.

Machinery Demonstrated.

GL-171 *Single Furrow Plough.*—This implement, direct-connected to the tractor, is primarily for deep ploughing—to a depth of 12 inches where soil conditions permit. The plough is raised and lowered by merely pulling a trip rod, which sets the hydraulic mechanism in motion. It is not a stump jump plough, but has a safety device which operates if an obstruction is hit; if that happens, the beam simply breaks back.

"Little Genius" Plough.—This implement is designed to plough 6 to 8 inches deep, but shallower if necessary. It can be hitched to any type of tractor, and although not designed as a stump jump plough, it is protected by a safety release at the coupling point with the tractor. Another "Little Genius" type, also seen in action, has an additional beam and a narrowed cut for shallower ploughing.

Tractor Disc Harrow.—This is an improved tillage implement with cutaway disc to obviate the "balling up" of trash or weeds in front of the discs.

Meeker Levelling Harrow.—This implement is an Australian improvement on an imported model, so designed that necessary repairs may be well and cheaply done, and is entirely new to Australian vegetable culture. It is essentially a finishing tool in the preparation of a finely surfaced seed bed.

Planter Units.—The planter units have the Planet Jr. type seed boxes. The planting mechanism is in plain view and under the immediate control of the operator. These units are built to plant four rows at a time, of both small and large seeded crops.

Plate 155.
YOUNG AUSTRALIA ACHIEVES HIS AMBITION.

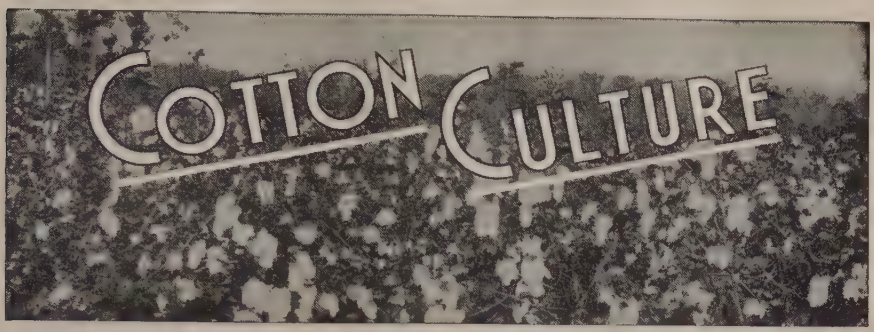
Four-row Vegetable Cultivator.—This mechanism will cultivate from 18- to 28-inch rows on the flat and on each side of the tractor: row spacings can be cut down to 14 inches. In cultivating carrots with 18-inch row spacings it works very close to the row without pulling up the plants; it, therefore, solves an inter-row cultivation problem familiar to carrot growers.

Two-row Cultivator.—This implement will cultivate any row crop from 28- to 48-inch row spacings. It takes in potatoes, tomatoes, maize, and other row crops grown with those spacings, and provides clearance up to about 30 inches. At that height a cultivating speed of 3 to 3½ m.p.h. can be maintained. Provision is made for vegetable bar attachments, enabling four rows to be cultivated at a time.

25-*V Mower.*—This is a universal type mower, but with different couplings, which enables it to work with practically any type of tractor; it may be regarded, therefore, as a general purpose mower. Power is transmitted from the tractor, through a power take-off shaft to the power take-off coupling on the mower. Safety clutches and quick releases are provided to prevent damage to equipment if obstructions are encountered in the field.

Plate 156.

A MILK PRODUCTION DEMONSTRATION ON A BRITISH FARM.



Commercial Cotton Varieties in Queensland.

R. W. PETERS, Research Officer.

(Continued from p. 213, April, 1944.)

Miller.

THE Miller variety is a big-bolled, medium-stapled American Upland cotton, which has been grown for many years in the United States of America. A new strain of it evolved in 1926 was introduced to Queensland in 1930. In the first few seasons' trials of Miller in this State, satisfactory yields were obtained but some difficulty was encountered in the harvesting operations through the locks of cotton sticking in the bases of the bolls. This tendency was eliminated, however, in the breeding plots and the variety is now noted for its easy picking qualities. Unfortunately, it has not been possible to evolve a satisfactory strain showing any marked superiority to the parent in regard to either a higher lint percentage or the elimination of the tendency to develop a considerable number of supplementary small vegetative branches when the variety is grown on fertile soil in a very wet season. It would also be beneficial if the variety was slightly earlier maturing. A comprehensive breeding programme aiming at improving the variety in these respects is being carried out in the Callide Valley—the district in which the greatest acreage of it is annually grown. An extensive breeding programme to evolve jassid-resistant strains of the variety has also been operating in this district along the lines described in the October, 1943, number of this Journal.

The yielding ability, size of boll, ease of picking, and the general tendency of the variety to produce high-grade cotton of a type required by the Australian spinners has made Miller popular whenever conditions are suitable for it, and it is the most extensively grown variety. Its popularity has also been increased by its partial resistance to the attacks of the leaf-sucking jassid, an insect which can cause serious loss of crop in cottons non-resistant to it. The average Miller plant is of medium size, with one to three basal vegetative branches which may be fairly large. The foliage is medium to large and dark-green in colour. The main axis is usually erect and slightly taller than Lone Star but not as sturdy. The fruiting branches are numerous but only of medium length. The fruiting arrangement is fairly open, which allows of good spacing of the bolls. Bolls are large, sixty to sixty-five to the pound, with a preponderance of five locks, which open well and are moderately stormproof. The fibres, which are of medium to full body, have a staple length of

1 inch and are very strong. The colour of the fibre is white. The lint percentage ranges from thirty-four to thirty-five.

The variety is recommended for the following soil types in the indicated districts:—

Northern Darling Downs and Maranoa—

The loamier soils of the rising lands and foothills of the Main Dividing Range, originally timbered mostly with box forests.

The more fertile loams of the belah flats.

The most moisture-retaining areas of the fertile red loams originally under either forest or scrub.

Southern District—

The soils of the slopes originally under scrub.

The more fertile loams to clay loams of the slopes originally under forests.

The less fertile clay loams of the alluvials.

South Burnett—

The black and the brown loams and clay loams of the lower slopes originally under silver-leaf ironbark forests.

The less fertile grey loams and clay loams of the lower slopes originally under good-sized box trees.

The fertile brown and red-brown loams and clay loams of the scrub series.

Central and Coastal Burnett—

Miller does not appear to be suited to these districts except on the decomposed granite soils in the Mount Perry-Boolboonda section of the Coastal Burnett.

Upper Burnett—

The soils of the slopes originally under box or ironbark forests.

The soils of the scrub series, especially where attacks by jassid are usually experienced.

Central District—

The soils of the forest series on either alluvial or slopes except the very fertile loams or sandy alluvial loams adjacent to creeks.

The soils of the scrub series.

Triumph.

This variety, which is known as Oklahoma Triumph in the United States of America, was introduced from that country in 1933. When it was first planted in Queensland it was obviously genetically impure as a wide range of plants could be seen in any well-grown field of it. Some of the plant types appeared very promising and the purification of the most attractive of them was, therefore, undertaken. Fortunately, the variety responded remarkably well to methods of improvement by individual plant selection, hence in a few years promising progeny increases were being tested and in 1938 the first improved strain was released for commercial distribution. Other improved strains of Triumph now available give definite promise of being important acquisitions to the

list of commercial cottons being grown in Queensland—mainly on account of their earliness, prolificness, and suitability for very fertile soils.

The following is a description of a typical plant of the main Triumph strains now being grown.

Main axis erect and of medium height but inclined to bend over when bearing a heavy top crop. There are generally one to three vegetative branches, but usually they do not develop vigorously. The fruiting branches are numerous, horizontal, and long on the lower part of the plant but shorten slightly higher up on it. The foliage is of medium size and dark green. Bolls are of medium size and occur roughly in equal proportions of five and four locks. Storm resistance is not good. The fibres average 15/16 of an inch in length, are of medium body, fairly good strength and of medium drag, while the percentage of lint ranges from thirty-four to thirty-five.

In a season when the planting rains do not occur until it is too late to plant the big bolled, later maturing varieties, Triumph can be planted as late as December on all soils that are moderately fertile with good chances of obtaining a profitable yield. Triumph is also the only "safe" variety of cotton to plant on the most fertile alluvial loams in the wetter districts. It has been demonstrated that in areas which are regularly subject to jassid attack, early plantings of this variety can produce a satisfactory crop before the jassid population is sufficiently large to affect the growth of the plants. Another important feature of Triumph is its ability to develop a heavy crop after having received a setback caused either by insect activity or adverse climatic conditions.

The distribution of Triumph is very wide, in fact it is grown regularly in all of the most important cotton districts except the main sections of the Central District. The following soil types are recommended for the variety in the main cotton-growing districts south of Mackay.

Northern Darling Downs and the Maranoa—

The heavy black clays and clay loams of the mostly treeless plains. Early autumn ploughing is especially advisable for these soils so as to provide all possible subsoil moisture for this variety. It is also highly necessary to cultivate frequently on these soils to minimise the danger of severe cracking of them causing rapid loss of moisture.

The fertile loams and clay loams of the softwood scrub series.

The very fertile loams of the alluvial soils along the main creeks and in the folds and valleys of the Main Dividing Range.

Southern District—

The fertile loams of the alluvials of the main valleys—especially if irrigation facilities are available.

The fertile loams and clay loams of the first bench of either forest or scrub soils in the narrow side valleys entering the main valleys.

The most fertile of the loams of the softwood scrub series.

South Burnett—

The most fertile loams and clay loams of the alluvials—especially if irrigation facilities are available.

The fertile loams and clay loams of the softwood scrub series.

Central Burnett—

The fertile loams of the alluvials, especially if irrigation facilities are available.

The fertile loams and clay loams of the softwood scrub series.

The fertile loams and clay loams of both the forest and scrub series on the slopes in the general Dallarnil and Biggenden districts.

Coastal Burnett—

The fertile alluvial loams of the coastal plain.

The more fertile scrub and forest loams of both the slopes and the alluvials in the inland sections of the district.

Upper Burnett—

On soils similar to those recommended for the South Burnett.

Especially recommended for fertile alluvials where irrigation facilities are available.

Central District—

Recommended only for the fertile soils of the coastal section of this district. Also, in seasons of late planting rains, may be planted on the more fertile loams of forest and scrub series of inland sections of the district. Not recommended for early planting in these latter sections of the district.

New Mexico Acala.

This strain of Acala was introduced into Queensland in 1934, from the Field Station of the United States Department of Agriculture, State College, New Mexico. Starting with the first year of testing under Queensland conditions, the variety has been remarkable for its uniformity of characters and although "New Place Effect" has subsequently caused some slight variation of characters, it still retains a good standard of uniformity. In fibre qualities it is one of the outstanding varieties grown in Queensland, characters as body, drag, lint percentage and lint index all being of a very high standard.

The plant is of medium height with a strong, erect main stem. Basal vegetative branches generally vary from one to three, with one usually being of vigorous growth. Fruiting branches are somewhat short jointed, with the lower branches long, while the upper ones become short towards the apex of the plant. Leaves are medium to large in size and dark green in colour, with the lobes being mostly long and pointed. Bolls are of medium to large size, ovate to ovate oblong in shape with a rather short blunt point and weigh 50-60 per lb. The bracts are rather small for an American Upland type. The bolls are often pendent, open wide and have good storm-proof qualities. Lint has an average length of 1 to 1 1-16th inch with good drag and strength, is usually heavy bodied, clear white in colour and the percentage of lint averages 37 in well-grown cotton. In the shape of the plant, the type of boll and in the quality of the lint, New Mexico Acala is distinct from all other varieties grown in Queensland. It matures earlier than other big bolled cottons and has the ability to mature much of its crop at once.

New Mexico Acala has replaced all other strains of Acala grown in Queensland. Unfortunately it is extremely susceptible to attacks from jassids which limit its sphere of usefulness in areas where this pest

occurs. It also does not appear to be able to withstand adverse conditions as well as either Lone Star or Miller, both of which are coarser bodied cottons. A comprehensive breeding programme is therefore being carried out in the variety aiming at both increasing its jassid resistance and obtaining a slightly more drought resistant type.

The variety is recommended for the following soil types in the indicated districts:—

Northern Darling Downs and Maranoa—

The loamier soils of the dark brown clay loams of the forest series.

The clay loams of the alluvials where irrigation facilities are available.

Southern District—

Results obtained so far in trials have appeared to indicate that the variety has only limited possibilities in this district.

South Burnett—

The dark brown clay loams of the lower slopes originally timbered with silver leaf ironbark.

The less fertile heavy clay loams of lower slopes and alluvials originally under box forest, more particularly in the first three seasons after the breaking up of grassland.

Central and Coastal Burnett—

Not recommended for these districts.

Upper Burnett—

The loams and clay loams of the alluvials in the southern section of the district. Not recommended for the northern half as the soils are too fertile and jassid attacks are frequently experienced.

Central District—

The fertile loams and sandy alluvial loams of the forest series adjacent to creeks in all but the coastal section of this district. The variety appears to be particularly suitable for growing with supplementary irrigation, and has largely replaced Miller on the Theodore irrigation project.

Farm Relief.

This variety was introduced from the United States of America in 1930. It is slightly earlier than New Mexico Acala, and when grown well is a most attractive cotton, the plant being of an open symmetrical habit with good internode space between both fruiting branches and the bolls. Unfortunately, the variety requires ideal growing conditions, under which excellent yields of good quality cotton have been obtained.

Plants are fairly tall, with a strong main axis, basal vegetative branches usually two to four, two being moderately vigorous in growth. Fruiting branches are long, gradually shortening towards the apex of the plant, and tend to be horizontal, which, with the good spacing of the internodes on both the main stalk and branches, gives the plant a very open appearance even when tall. Foliage is medium to large, dark green in colour. Bolls are medium to large and open well with fairly good

storm-proof qualities. Fibre has a staple length of 1 1-16th inch. The strength is medium while the drag is good. The character of the fibres varies somewhat, and breeding work is under way in the variety, aiming at improving the character of the fibre yet retaining the dominant attractive habit of growth.

When grown under ideal conditions the variety is most prolific. Its distribution is decidedly limited, however, on account of its inability to withstand any harsh growing conditions. Under such treatment the fibre is weak and wasty, but under irrigation the variety has produced excellent yields of high quality cotton on moderately fertile clay to clay loam alluvials. It is therefore confined to this class of soil in the Southern district, and the South and Coastal Burnett districts.

Other Varieties being Tested in Queensland.

In addition to the five main varieties which have just been described, the Cotton Section of the Department of Agriculture and Stock has under investigation a number of other varieties which have more recently been imported. As the full possibilities of these cottons become more understood, the most promising of them will be tested in a comprehensive set of district trials to ascertain their merits as compared with the main varieties grown. Any of these newer varieties showing superiority in the district tests will be multiplied sufficiently to enable a limited number of farmers to grow them commercially. If the general results obtained in these large scale trials also indicate one of the newer varieties to be superior to the varieties now grown, seed stocks of it will be increased as rapidly as possible for general distribution in the district concerned and a breeding programme will be inaugurated to maintain the variety on a high standard of performance.

In Memoriam.

A life of achievement and service to Queensland ended with the death of the Hon. Digby Frank Denham on 10th May at the age of 85. The late Mr. Denham was Premier of the State from February, 1911, till June, 1915, and had previously held the portfolio of Minister for Agriculture and Stock. Born at Laneport, Somerset, England, in 1859, he came to South Australia in 1881 and to Queensland five years later, and established a business which subsequently became Denham's Proprietary, Ltd. In 1893, with the late J. C. Hutton, and in association with the late John Reid, he started butter and cheese factories on the Darling Downs. In 1902 he entered the State Parliament as member for Oxley. To the end he remained a man of high-minded and loveable nature, full of imaginative fire, force, and sincerity.

Fruit Growing in Tropical Queensland.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

ALTHOUGH North Queensland is situated well within the tropics, there are very few fruits which cannot be grown successfully in at least some portion of that region. In the course of a recent casual tour of one northern city over thirty species of fruits, both tropical and temperate, were found growing in home gardens. However, while this may be successfully accomplished under garden conditions, the commercial growth of various fruits is practicable only in localities most suited to the particular species. Tropical fruits and citrus are grown successfully over the long coastal strip from Cooktown to Bowen; citrus and grapes thrive in the inland district of Charters Towers; and grapes and plums are grown around Herberton and Ravenshoe on the Atherton and Evelyn Tablelands. In this vast territory there is, of course, a wide range in climatic conditions, so the right species of fruit for a particular locality should be selected.

In dealing with a subject covering such a broad field as this, it is not practicable to enter into detailed information on each fruit in each locality. It is proposed, however, to deal briefly with the more important fruits, stating the districts in which they are chiefly grown, and the advantages and disadvantages attendant on their culture. While only certain districts will be mentioned, it does not follow that these are the only districts in which such fruits are grown or can be grown. It means only that they are the present principal centres of production for those fruits.

The principal commercial fruits grown in North Queensland are citrus, pineapples, bananas, papaws, mangoes, granadillas, and grapes. Those of lesser importance are passion fruit, plums, litchis, persimmons, avocadoes, and sugar apples. In addition, very many little-known tropical fruits are represented by odd specimens, but seldom marketed.

Citrus.

District centres of commercial production of citrus fruits are Cooktown, Cairns, Cardwell, and Charters Towers. Of these districts, both Cooktown and Cairns were large and well-known producing areas thirty years ago, but in recent years have receded somewhat from their leading position in the industry. At Cooktown, isolation from markets has had a deterrent effect on production, but citrus production continues to a limited extent. Cooktown has an even climate, but usually experiences a dry spring and early summer, which retards the flowering of trees.

Plate 157.
A TYPICAL BANANA PLANTATION IN NORTH QUEENSLAND.

The result is a late-ripening crop, which because of its lateness is sold on local markets. At Cairns, the extensive industry of some years ago has given way to the more stable sugar industry, but considerable quantities of citrus fruits are still produced for local trade. Of the other two large producing centres, Cardwell is well and favourably known for its mandarins, and Charters Towers for its oranges. Cardwell's reputation is based on the Emperor variety of mandarin, which grows there to perfection. Charters Towers oranges are of several varieties, viz.:—Washington Navel, Joppa, Jaffa, and Valencia Late; irrigation is an essential of fruit growing in this district.

Plate 158.
BANANA GROWING ON ALLUVIAL FLAT LAND.—Note cultivation by horse-drawn implements.

In some districts, notably the dry area from Townsville westwards, foliocellosis is often present in citrus. Treatment with zinc sulphate

spray has produced good results in control. Seedling trees are largely grown in the wet coastal areas, and appear to be definitely hardier than budded trees, generally to be longer lived, and frequently more resistant to scale pests and disease under the conditions prevailing. The seedling orange and mandarin produced are of good quality and juice content, but are usually many-seeded. Furthermore, they usually ripen in the middle of the citrus season and so are often delivered on an over-supplied market.

A general varietal recommendation for citrus to cover an extended season in the various districts is:—(1) *Coastal areas*, White Siletta, Joppa, and Valencia Late oranges, Emperor and King of Siam mandarins, Marsh Seedless grape fruit. (2) *Inland* (Charters Towers), Washington Navel, Joppa, Jaffa, and Valencia Late oranges, Emperor, Ellendale Beauty, and King of Siam mandarins, Lisbon and Villa Franca lemons.

Plate 159.

PINEAPPLES IN NORTH QUEENSLAND.—Note the ground cover crop of Townsville lucerne (*Stylosanthes sundaica*) to prevent soil erosion.

Pineapples.

District centres of pineapple production are Cairns, Magnetic Island, Ayr, and Bowen. Around the northern centre, Rough Leaf variety is grown almost exclusively; at Magnetic Island, Rough, Ripley, and Smooth are all grown; at Ayr and Bowen, Smooth Leaf is the chief variety. Harvesting of the main crop around Cairns commences early in October and extends to December. In the other districts, harvesting is progressively later—Magnetic Island commencing in November, and the other districts in December. A winter crop is produced during the period from April to June, but it is considerably less in quantity than the summer crop. Local markets consume a fair portion of the production, but a considerable quantity also is forwarded to the southern fresh fruit markets. Processing of the fruit is not practised in the North.

Bananas.

The banana is now grown on a small scale only. Plantations occur over the whole coastal area from Cooktown to Bowen, and on the Atherton Tableland. In the tropics, this crop is only grown successfully on

low, alluvial flat land. Many plantations ten years old or more are to be found on this type of land still producing good fruit; while hillside plantings have generally failed after producing a single crop. In the drier areas of the North, irrigation is practised on a number of plantations. On cleared land, horse- or tractor-drawn implements are used in cultivation; but on newly-cleared stump land, hand implements are necessary. Cavendish is the principal variety, but some small areas of Sugar and Gros Michel have been planted. Generally, the first mentioned is the most satisfactory commercial variety.

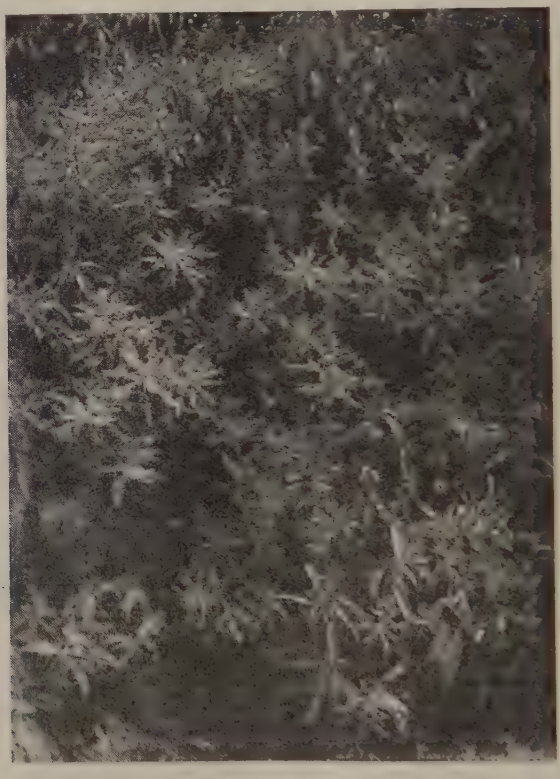


Plate 160.

"KENSINGTON" MANGO IN FULL BLOOM.—Illustrating profuse cropping habit.

Papaws.

Papaw production is confined chiefly to the Cairns and Townsville districts. Planting in the heavy rainfall area cannot be generally recommended, as the plants are very susceptible to "wet feet." Papaw soils should approach neutral in reaction, and should be free, deep, and well drained, yet with ample moisture always present. If the soil is acid the addition of lime—up to as much as 3 tons per acre—is necessary. The plant is a vigorous grower and a voracious feeder, so where soil is not rich, fertilizer must be applied. The bisexual varieties are largely grown, the type known as "Long Tom" or "New Guinea" being the ones most favoured. Good fruit of this type is about 12 to 15 inches in length and has thick flesh of a rich orange colour and fine flavour. There has been considerable degeneration in papaw varieties, however, and some

plantations show evidence that systematic rogueing of poor types would be beneficial. The need for care in the selection of seed is obvious.

Plate 161.
Granadilla "Shed."—Showing young vine and construction of trellis.

Mango.

The mango grows and fruits prolifically in every part of the North outside the heavy rainfall belt. In many areas, however, only the common stringy types are grown, and apparently little effort has been made to improve the quality. Fibrous types are of little value on the fresh fruit market, and should be used only for processing. Good commercial types are grown around Bowen and on Magnetic Island. These districts are becoming noted for several fibreless types of high quality, and for which there is a ready market. Seed of many of the good types do not always reproduce the high quality of the parent, and as this is the only method of propagation so far practised by growers, it

Plate 162.
A Northern Vineyard.—The wire-netting "umbrella" is a protection against predatory birds.

probably accounts very largely for the indifferent quality of the fruit offered for sale. Experimental vegetative propagation is now being carried out by the Department of Agriculture and Stock, and it is hoped that this method will soon supersede the old method of raising from seed, and so result in a general improvement in mango varieties.

In the regions of heavy rainfall the mango grows profusely, but rarely fruits well. The prevalence of anthracnose fungus in these districts is usually the cause of crop failure.

Granadilla.

Two varieties of granadilla are grown, viz.:—The large-fruited and the small-fruited. The plant is a climber of vigorous habit belonging to the passion fruit family. It is customarily grown on a horizontal overhead trellis supported on posts about 7 feet above ground, known as a granadilla shed. Like other passifloras, the fruit is produced on new growth, so regular annual pruning of vines is necessary to ensure vigorous and prolific new lateral growth.

The small-fruited variety is the one most favoured for commercial production, as it crops heavily under natural pollination. The large-fruited type is equally vigorous in growth and profuseness of flowering, but generally requires hand pollination to obtain good fruit setting.

Grapes.

The vine is cultivated in the Charters Towers and Herberton districts, the former being the chief producing area. In Charters Towers, the varieties most favoured are Royal Ascot and Muscatel. The fruit comes on the market before grapes from South Queensland reach the North in quantity, hence meets a ready demand. In the Herberton district, winter conditions are rarely sufficiently continuous to enable high-class European varieties to be successfully grown so in this area attention is concentrated mainly on the American varieties, those giving best results being Isabella, Goethe, and Ferdinand de Lessop. Muscatel, however, gives very fair results in some seasons. Fruit from this area finds a ready sale in the immediate district, and there is seldom any surplus for export to other districts.

Other Fruits.

Of the fruits of lesser importance, passion fruit grows readily in the coastal area and on the Atherton Tableland; in fact, it is a common natural growth in many of the jungle areas. Under cultivation, however, it is very subject to a base rot which frequently kills the vine before or immediately after the first crop.

Plums and persimmons are grown in the Herberton district, but both are subject to heavy attack by fruit fly, while the persimmon does not appear to be a popular fruit on local markets.

Litchis are grown mainly in the Cairns district, but difficulty in obtaining marcotted trees is retarding expansion. Seedling trees are unreliable in quality and fruiting habit, and, moreover, require 15 to 18 years to crop. Kwai mee and Wai chee varieties are at present giving best results.

The Avocado is not yet widely grown in the North, and is little known on northern markets. Present orchards are very restricted in

size and number, and are mainly planted with seedlings, which, under favourable conditions, commence fruiting at four years of age.

The Sugar apple is a common tree in most settled areas of the North as an escape from cultivation. It is cultivated in small areas in various parts of North Queensland. The tree is variable in habit because of the common method of raising from seed, but good types fruit heavily. The fruit is very sweet, but is many-seeded; it ripens rapidly on reaching maturity, and this habit makes it an unsuitable subject for extensive commercial growing.

Plate 163.

AN ENGLISH FARMER ROLLS A FIELD BROKEN UP AFTER A CENTURY OF GRASS.

The Need for Boron in the Nutrition of Vegetable Crops.

A. A. ROSS, Assistant Research Officer.

RECENT investigations have shown that boron plays an important part in regulating growth processes in plants and that this element is of particular importance to the reproductive organs. It is also claimed that boron controls the use of nitrates, phosphates, and calcium. As an example, boron-deficient sugar beet plants accumulate large quantities of nitrates, and the opinion has been advanced that the form which boron deficiency takes in this case is really an expression of nitrate poisoning. It is obvious, at least, that boron exercises a very complex and important influence in plant nutrition and that it must be included among the elements made available to plants through the soil.

Instances of boron deficiency have appeared on several of the vegetable-growing soils of south-east Queensland, but effective correction of the unsatisfactory forms of growth associated with this deficiency has been accomplished by the addition to the soil of boron in the form of borax. The trouble has been experienced mostly in crops of beetroot, although several cases of white turnips, swedes, and cauliflowers suffering from the complaint have also been encountered.

Symptoms in Beetroot.

Insofar as beetroot is concerned, girdle disease, black spot, or heart rot are names commonly applied to this disorder. However, as girdling is the symptom most frequently displayed in this State (Plate 164), "girdle disease" seems the most appropriate of the three names. The disorder first manifests itself in the largest plants in a crop and in those that are developing most rapidly. It is common, then, to find that the later a crop is left before harvesting the greater will be the incidence of girdling. Symptoms are most pronounced in the "root," which may be partially or completely encircled by dark, sunken, corky areas, developing at or below ground level (Plate 165). These lesions are frequently invaded by a fungus which imparts a greyish coloration to the affected area, and such "roots" are badly disfigured and rendered unfit for market. In some cases the most obvious symptom is the occurrence of black, corky spots in the interior of affected "roots," and these may, or may not, be accompanied by surface girdling.

Foliage symptoms are not reliable in diagnosing this disorder as, at times, an apparently normal top may be associated with a "root" showing girdling. However, when foliage symptoms do appear, the

youngest leaves are affected first. Long, narrow, and slightly cupped leaves are then produced, and sometimes only one-half of the blade is developed. In later stages leaves turn yellow prematurely. At times multiple crowns are produced, rosettes of small leaves appearing at several points around the original crown. These small leaves tend to die back from the tip, and ultimately drop off. It has been shown that where beetroot plants have been grown for seed those showing symptoms of boron deficiency in their first season fail to produce seed in the normal manner in the second year.

Symptoms in White Turnips and Swedes.

When the trouble occurs in white turnips and swedes the symptoms in general are similar to those occurring in affected beetroot crops. In mild forms of the disorder abnormality shows only internally in the "root," and the disease is then appropriately named "brown heart" because of the characteristic greyish-brown colouration, which is developed in the centre of the "root." Where the deficiency is acute, foliage symptoms present themselves, and a certain degree of roughness can be discerned on the surface of the root; leaves become distorted, yellowed, and mottled with a purplish tinge round the margins, and the leaf stalks frequently split; multiple crowns also occur (Plate 166). In severe cases the diseased tissue in the centre of the "root" collapses, and this collapse is followed by the entry of organisms which produce a soft rot accompanied by a foul odour; the centre of the "root" finally becomes hollow. As with beetroot the trouble first develops and becomes most severe in the largest plants in the crop. In all cases, even where only slight browning is in evidence, the "roots" develop a stringiness which becomes more pronounced on boiling.

Plate 164.

GIRDLING ON BEETROOT.—A symptom of boron deficiency.

Symptoms in Cauliflowers.

Until the curd begins to form no external symptoms of boron deficiency are developed in cauliflowers. The first sign of the disorder in this vegetable is the appearance of small water-soaked areas in the centre of the main stem and small branches of the curd: in later stages, the stem becomes hollow with water-soaked tissue surrounding the walls of the cavity (Plate 167). The first external symptom is the appearance of distorted inner leaves, which may be so reduced as to consist only of the mid-rib; in more advanced stages, pinkish or rusty-brown areas, to which the name of brown rot or red rot is applied, develop on the surface of the curd. Browning of the curd does not always accompany the hollow stem, but, in severe cases, both symptoms are invariably present. Ultimately, decomposition organisms produce a foul-smelling rot, and the head is rendered completely worthless (Plate 168). Affected heads develop a bitter flavour, which persists after cooking.

Plate 165.

GIRDLING AND MULTIPLE CROWNS ON BEETROOT.—Symptoms of boron deficiency.

Relationships Between Boron and the Soil.

Whilst boron deficiency is most pronounced on alkaline soils it may also occur on acid soils. In south-east Queensland it has been found on acid soils where the pH ranges from 5 to 6. Liming has the effect of accentuating the trouble or of inducing it on soils in which the supply of available boron is low. The exact nature of the effect of liming is not completely understood, but the intensification of the trouble appears to be the result of the change in soil reaction rather than of the increase in soil calcium. However, one possible explanation is that lime may have the effect of rendering the boron unavailable to some extent, or it may be that the increased growth induced by the addition of lime to an acid soil

may make a greater demand on the supply of boron present, thereby emphasising the deficiency. It is also possible that one effect of lime on micro-organisms is to increase their use of boron. Whatever the explanation may be, it is known that the addition of lime to the soil does increase the trouble and that such a deficiency induced by lime can be rectified by the application of suitable boron compounds to the soil.

Plate 166.
Multiple Crowns on White Turnips.—A symptom of boron deficiency.

As is usually the case with deficiency diseases, the incidence of the disorder tends to increase under drought conditions. It is only reasonable to expect that the availability to the plant of an element would be reduced under conditions of low soil moisture and that this would be particularly important in the case of elements such as boron, which are normally present in the soil in very small proportions. It must always be borne in mind that regularity of soil moisture supply throughout the growing period of the crop is of greater importance than the total amount of water. Thus, soils of low moisture-holding capacity, especially where the physical condition is poor, shallow soils with a compact subsoil, and soils made shallow by the presence of a hard pan

are particularly liable to produce the trouble as the result both of irregularities in water supply and of restriction in root growth.

Boron deficiency is most commonly found on light-textured soils in regions of heavy rainfall, but, because of their low capacity to fix this element and thus make it unavailable to plants, the trouble on this type is more easily rectified than on heavy coarse-textured soils.

All plants absorb a certain amount of boron, and in many vegetable crops this represents a heavy loss to the soil as much of the element is stored in those parts of the plant which are sent to market. When such crops are grown regularly it is obvious that some replacement of boron should be made.

Results of Experiments.

Trials involving the application of boron have been conducted in the Sunnybank and Brookfield districts. Girdle disease of beetroot was prevalent in the Sunnybank district, and investigations were commenced to establish the cause of the trouble and to demonstrate an effective control. A site was selected where the disorder had appeared in the previous season, and a randomised block experiment of four treatments replicated six times was laid down. The soil reaction was pH 6·0. The dressings given comprised 20 lb., 40 lb., and 60 lb. of borax per acre, and a no-treatment control was included. The borax was applied in one application when the plants had reached a height of about 1 inch. The required amount of borax for each plot was dissolved in four gallons of water, and applied along the rows of plants by means of a watering can, thus ensuring a very uniform distribution. Cultural practices such as fertilizing, cultivation, and irrigation were the same on all plots, and were those normally practised by the grower. At the time of harvesting a count was made of healthy and affected plants, the results of the count being as follows:—

—	Healthy Beetroot.	Affected Beetroot.	Percentage Affected
1. Borax—60 lb. per acre	1,079	73	6·3
2. Borax—40 lb. per acre	1,096	78	6·5
3. Borax—20 lb. per acre	1,060	69	6·1
4. No treatment	825	311	27·3

From the above figures it can be seen that borax produced a considerable reduction in the incidence of the disorder, but there were no significant differences between the results obtained with the various amounts of borax. In other words, 20 lb. per acre was sufficient to effect a control, while heavier treatments of up to 60 lb. per acre did not produce any injury. Complete control was not effected by any treatment, and this suggests that other factors, such as time, and method, of application, required attention. In addition to providing a definite diagnosis of the trouble this trial demonstrated the symptoms which may be taken as being representative of boron deficiency in beetroot.

At Brookfield, cauliflowers exhibited symptoms which closely conformed to those which occur in boron-deficient plants. As symptoms of this trouble in beetroot could be recognised with certainty, a trial was conducted during the spring, using beetroot as an indicator crop, in order to obtain the required information before the next crop of cauliflowers

was due to be planted. A randomised block experiment of six treatments replicated four times was laid down. This included three levels of borax, manganese chloride, zinc sulphate, and a no-treatment control. All materials were dissolved in water and applied by means of a watering can along the rows of plants. The soil reaction in this case was pH 7·05. The total number of plants, the number of plants affected, and gross weight of plants per plot were recorded on harvesting. The treatments and the chief results obtained were as follows:—

—	Healthy Beetroot.	Affected Beetroot.	Percentage Affected.
1. Borax—20 lb. per acre	783	7	·94
2. Borax—10 lb. per acre	741	13	1·73
3. Borax—5 lb. per acre	787	15	1·88
4. Manganese chloride—20 lb. per acre ..	636	38	4·94
5. Zinc sulphate—20 lb. per acre	715	62	7·99
6. No treatment	704	52	6·46

There were no differences between the average weights of plants produced as a result of the various treatments, and these are therefore not shown in the above table.

These results show that borax reduced the incidence of the disorder, but again there were no significant differences between the effects of the various levels of borax, and the upper level, i.e., 20 lb. per acre, did not produce any injury. On this area the incidence of the disorder on untreated plots was much less than in the Sunnybank area, which partly explains the more complete control effected. The trial served to indicate that the soil was deficient in boron, and that in crops of cauliflower, beetroot, white turnip, and cabbage grown on it improvement could be expected as the result of applications of this material.

Treatment of Deficient Soils.

The only means of controlling boron deficiency disorders is by applying a suitable boron compound to the soil. Commercial borax is satisfactory and is a substance which is usually easily obtained. Boric acid is also a common material, which is equally suitable. It must be remembered, however, that for this purpose 7·7 parts of boric acid is equivalent to 12 parts of borax, and quantities must be proportionally adjusted when boric acid is used in place of borax.

Whilst it is advisable that boron be applied to the soil before planting or before transplanting seed-bed-raised crops, applications after the plants have become established are also successful. Any practical method which will make an even distribution of the small amount required may be employed; thus it may be combined with the fertilizer, diluted with a carrier such as kaolin, or dissolved in water; it may be applied in the drill, at the sides of the drill, or broadcast. A 2 per cent. solution in water applied to the soil and foliage with a watering can or knapsack sprayer will prove effective.

As the amount to be applied varies with the crop grown, the soil reaction, the soil type, and the degree to which the soil is deficient, it is not possible to make any general recommendations as to the rate of application. For the more boron-sensitive plants reduced quantities will have to be used to avoid toxicity. Table 1 serves to indicate the

degree of tolerance to boron exhibited by various crop plants, and gives a guide to the quantities of borax to apply. Maximum quantities which can be applied without producing injury are given, but satisfactory control can usually be obtained from smaller applications.

TABLE I.

Very Sensitive. Maximum ; 5 lb. Borax Per Acre.	*Sensitive.* Maximum ; 10 lb. Borax Per Acre.	*Tolerant.* Maximum ; 20 lb. Borax Per Acre.	*Very Tolerant.* Maximum ; 40 lb. Borax Per Acre.
Bean	Celery	Cabbage	Beetroot
Cowpea	Pea	Carrot	Cauliflower
Cucumber	Potato	Lettuce	White Turnip
Strawberry	Rockmelon	Onion	Swede
	Squash	Radish	
	Watermelon	Sweet Potato	
		Tomato	

Plate 167.

HOLLOW CENTRE OF CAULIFLOWER.—A symptom of boron deficiency.

On some soils, the results of boron treatment may be as effective in the second season as in the season of application, but from what is known of the availability of boron, it is considered better to apply smaller amounts each season than larger amounts to cover requirements for two or more seasons.

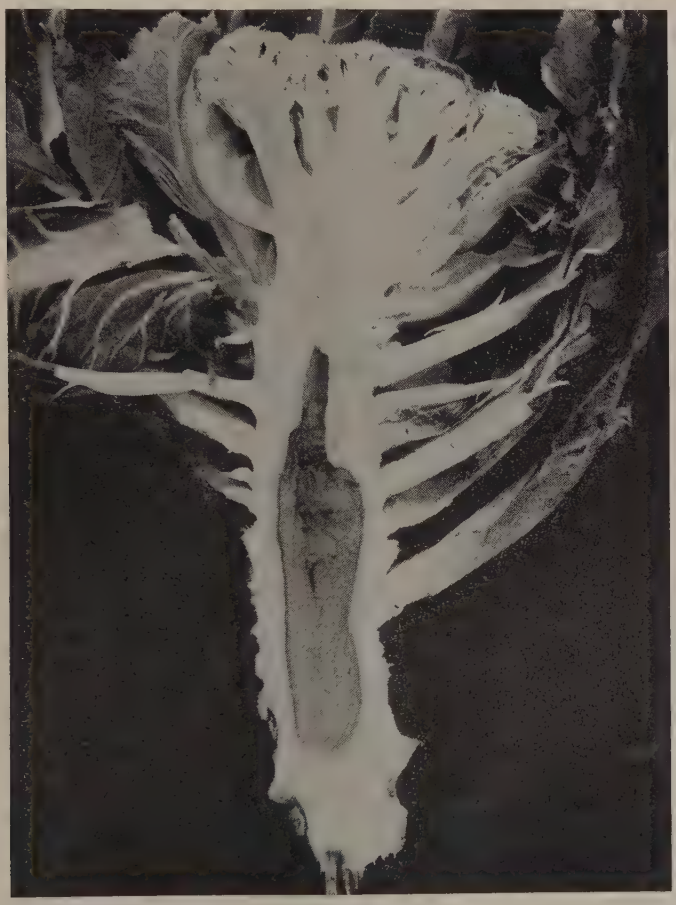


Plate 168.
HOLLOW CENTRE AND INTERNAL ROTTING OF CAULIFLOWER.—Symptoms of boron deficiency.

Boron Toxicity.

Under natural conditions, boron toxicity is not liable to occur, except in very arid regions, and in practice is usually found only as the result of excessive boron applications. The boron requirements of different species of plants vary considerably, and, in general, those most readily affected by a deficiency are not injured by amounts which would be toxic to other less tolerant species. On field trials, dosages of 200 lb. per acre have proved lethal to most plants, while the more susceptible species have been injured by as little as 5 lb. per acre.

Should boron accumulate in the soil to the extent of becoming toxic the growing of tolerant crops is perhaps the most effective way of reducing the concentration of boron in the soil. Heavy irrigation with a water

free from boron tends to decrease the concentration of boron in the soil solution, and also leaches out some of the soluble boron. In acid soils the uptake of boron may be inhibited to some extent by the application of lime.

Generally, the symptoms of boron toxicity develop first in the leaves, as it is in these organs that the greatest accumulation of the element takes place. In crop plants, symptoms are generally very similar in all species. Initially, yellowing begins round the margins of the leaves, and then extends between the lateral veins towards the mid-rib. There is a tendency for the green colour to be retained towards the centre and base of the leaf until it falls. If the leaf is still growing, the margins turn yellow and die, while the centre continues to grow, thus producing a cupped leaf with dead tissue round the margin. It is usual for injured leaves to fall prematurely.

Spraying Weeds in Carrot Crops.

C. W. WINDERS, Assistant Research Officer.

Kerosene Weedkiller.

THE hand-weeding of carrot crops within a few weeks of germination is perhaps the most costly and laborious operation in growing the crop. The discovery in America that certain oils could be used to destroy young weeds without damaging the carrots has been followed up in Australia, and as a result a weedkiller is about to be marketed for the express purpose of eradicating the early weed growth. This weedkiller, to be known as "Pool Kerosene Weedicide," will be procurable in 44-gallon drums only, from the Brisbane depots of Pool Petroleum Pty. Ltd., whose offices are in Orient Line Building, Eagle street, Brisbane.

For some months past power kerosene has been used undiluted on carrot crops, with variable results. On some occasions it has been entirely successful, but some lots proved extremely harmful to the carrots as well as to the weeds. The new weedkiller has power kerosene as its basis, but is specially prepared and tested in order to ensure that its content of weedkilling compounds is below the figure which agricultural authorities regard as being dangerous to carrots.

Time to Spray.

There is a limited period during which carrots may be sprayed safely with kerosene weedkiller. This extends from the stage at which the carrots have two "fern" leaves to the stage where four "fern" leaves are present. If the spray is applied before the two "fern" leaves appear the carrot seedlings may be killed; if the carrots are sprayed after the four-leaf stage there is a definite danger that a kerosene taint will persist in the carrots and render them unfit for consumption. Only one spraying should be given.

During the cooler months of the year, the time of the day at which spraying is carried out should not have any great effect on the efficacy of the spray, but in the warm weather it may be desirable to spray in the cool of the evening in order to reduce evaporation of the kerosene to a minimum.

Quantity to Use.

Only sufficient spray to cover the weeds with a film of liquid should be used. Heavier applications, in addition to being wasteful of weedkiller, may cause injury to the carrots. An application of 80 gallons per acre of area actually wetted should suffice—that is, 4 gallons of spray should cover 66 chains of row sprayed in a strip 6 inches wide, which is equivalent to 27 gallons on an acre of carrots in rows spaced 18 inches apart. The nozzle used should have a fine jet and should preferably deliver a fan-shaped spray. The ordinary nozzles used on power and knapsack outfits may be used if the special type of nozzle is not available, but they will use more kerosene spray to cover the same area. Either the power or the knapsack spray pump may be used. Kerosene weedkiller will destroy practically all the weeds commonly encountered in southern Queensland in the autumn months, but its effect on some of the summer-growing weeds has yet to be tested.

Carrot Crops Only to be Sprayed.

Members of the carrot family are the only vegetable crops known to possess resistance to injury by kerosene weedkillers, and these materials should not be used for the present on any crop but carrots. It is probable that parsnips can be sprayed satisfactorily, but details of the required strengths and time of application are not yet known.

Plate 169.

Hauling Home-grown Timber from an English Forest.

The Algaroba Bean or Mesquite as a Pest Plant.

C. T. WHITE, Government Botanist.

THE importance of the algaroba (*Prosopis juliflora*) as a fodder tree in Hawaii led to its introduction into Queensland many years ago. Professor J. F. Rock, the famous botanist, who for many years resided in Hawaii, described it as by far the most common as well as the most valuable of the introduced trees of the Hawaiian islands. Land which, prior to the introduction of algaroba, was absolutely barren has been covered with dense forests of algaroba, which not only supply excellent firewood but furnish flowers with nectar, valuable for honey-making, and produce pods, which are eaten by all classes of grazing animals. Algaroba is regarded in Hawaii as the most valuable forage plant in certain parts of the Territory.

However, in parts of the United States—particularly in the States of Texas, Arizona, and New Mexico—algaroba, or mesquite as it is known there, is regarded as a serious pest of grazing country. As conditions in those areas are closer to those of the pastoral land of northern and western Queensland than are Hawaiian conditions, the Department of Agriculture and Stock has opposed the planting of algaroba in the pastoral districts of the State. Recent publications issued in the United States have emphasised the growing importance of mesquite as a pest and the difficulty of reclaiming land invaded by the plant. For example, it is stated in a recent number of "Soil Conservation," the official organ of the United States Soil Conservation Service, that the destruction of mesquite on Texas Ranges (*i.e.*, pastoral country) is one of the major problems of that area. The steady increase of the trees and bushes of mesquite has gradually and materially reduced ranch income, lowering the State's potential meat production for the war effort. It is estimated that on land where mesquite is growing it requires from 12 to 100 acres to maintain a cow or its equivalent, the area depending upon the degree of infestation. When average figures are applied to areas in Texas, the possible production on the mesquite-covered area is 2,368,421 cows or their equivalent, whereas if the mesquite were removed and normal grazing capacity restored the number would be 3,750,000. Expressed in beef production, this would represent over 50 per cent. increase. Eradication work, whether by hand-grubbing, by chemical methods, by the use of tree-dozers, or by the use of a mobile circular saw followed by swabbing, is relatively costly.

Officers of this Department who are familiar with infested areas in the United States have always been afraid that the algaroba, once introduced, might get out of control and spread in the pastoral districts, particularly along western river channels, leading to reduction in carrying capacity. The information quoted above should suffice to justify the caution which the Department has exercised. Enough pests have been introduced unwittingly without encouraging what may well be regarded as a potential serious pest.

ANSWERS.

Yellow Daisy—A Plant Poisonous to Sheep.

G. B. (Bookin Siding, Cloncurry Line)—

The specimen is *Wedelia asperrima*, commonly called the yellow daisy, a plant very widely spread in North Queensland and the Northern Territory. Feeding tests have shown this plant to be poisonous to sheep, causing symptoms similar to those of pneumonia.

Rivina—A Milk-tainting Weed.

S.E.P. (Rockhampton)—

The specimen is the Rivina Weed (*Rivina humilis*), a native of South America, now a common naturalised weed in Queensland. It is particularly abundant in Central Queensland, especially around scrub edges, along fences, and similar places. It is one of our worst milk-tainting weeds, but so far as known has not previously come under suspicion as tainting flesh, but this is quite likely.

Nut Grass.

T.R.F. (Urangan)—

The specimen is the real Nut Grass (*Cyperus rotundus*), which is such a pest in cultivation in Queensland. Fowls and ducks, particularly the latter, generally manage to keep the plant in check and eventually eradicate it, as they pick off the green shoots as soon as they appear above ground and, consequently, the tubers eventually shrivel.

Indigo.

H.V.P. (Kolan River)—

The specimen is a species of Indigo (*Indigofera suffruticosa*), supposed to be a native of tropical America but now widely spread over the tropical and subtropical regions of the world. It is a legume and although there is no available information as to its being eaten to any extent by stock, it should be quite a valuable fodder. Other species of Indigo in our pastures are eaten and generally regarded as nutritious. The plant is very common in North Queensland but in the southern parts of the State, mostly inland, a few patches here and there are seen, but not in any great abundance. It has been established as a minor weed about Bundaberg for many years. It is possible that stock keep it in check. The plant should be a valuable green manure. It is not known to be poisonous or harmful in any way.

Pigweed.

F.E.C. (Townsville)—

The common Pigweed of Queensland is *Portulaca oleracea* and is frequently used as a green vegetable. The other plants known as Pigweed are species of *Trianthema*. These are not used for food but are not known to be harmful in any way.

Wild Senna.

B. (Morganville)—

The specimen is Wild Senna, also known as Yellow Pea or Arsenic Bush along with other species of *Cassia*. Feeding tests have shown this weed to have a somewhat purgative effect, but otherwise harmless. The plant is a common tropical weed and in the West Indies the seeds are said to be used, ground up, as an adulterant of coffee.

PLANT PROTECTION

Deficiency Diseases of Citrus.

W. A. T. SUMMERVILLE, Senior Research Officer, and F. W. BLACKFORD, Assistant Research Officer.

IN addition to the diseases which are caused by the activities of parasitic organisms, citrus trees may be affected by a number of physiological disorders. In Queensland, the more important of these are connected with inadequate supplies of certain essential plant food materials. Disorders of this nature resemble plant parasitic diseases in a general way and are commonly known as deficiency diseases. Usually, however, they result in the production, by the tree, of abnormal tissue rather than in the death of parts, though death may follow through the inability of the plant to function normally. In these diseases, the abnormality is most commonly encountered in the size, structure, and colour of affected parts.

The total absence, insufficiency, or unavailability of any one of the many elements required for the normal growth of the citrus tree could lead to a deficiency disease, but, in this State, such a trouble is usually attributable to a lack of one or other of eight elements, and of these the only ones which have so far been associated with serious losses are zinc, copper, nitrogen, and iron. In the case of most elements, it is usual to refer to the disease as a deficiency of the element concerned as, for example, nitrogen deficiency or iron deficiency. In certain cases, however, the disease was of importance for a considerable period before its cause was discovered, and in these cases names were given which were descriptive of the symptoms. Thus zinc deficiency was known as mottle leaf and copper deficiency was called exanthema. It seems desirable that these terms be retained and, accordingly, zinc and copper deficiencies in citrus are discussed in this article under their old names. As they are of particular importance, these two diseases will be considered at some length. Nitrogen deficiency will be discussed in sufficient detail to ensure that the type of symptom associated with such malnutrition will be made clear. Briefer, but adequate, reference will be made to iron deficiency.

MOTTLE LEAF.

Several causes lead to mottling of the leaves of citrus trees, but, in Queensland, the term "mottle leaf" is usually applied to the particular type of mottling which is brought about by the trees not receiving adequate supplies of zinc. In this type, the green colour is absent from irregularly-shaped patches between the veins, whilst the veins themselves remain green and often appear rather deeper in tone, against the creamy-yellow patches, than the veins of normal leaves (Plate 170). In addition to showing the mottled effect thus created, the leaves of affected trees are often markedly reduced in size and rather more elongated and pointed than normal leaves. Furthermore, these mottled leaves develop a harsh appearance and become distinctly brittle.

Plate 170.
MOTTLE LEAF OF CITRUS.
Normal leaf on extreme right.

Reduction in size and the development of brittleness, however, may also characterise some normally-coloured leaves on affected trees, whilst, inside, succulent growth is often healthy and vigorous, even when the more-exposed foliage is almost wholly mottled. Affected trees produce small, unmarketable fruit which generally colours prematurely and remains hard and woody. Trees affected by mottle leaf are seldom killed, but usually become worthless.

Plate 171.

EXANTHEMA ON ORANGE.—*Left*: Malformed and multiple buds. *Right*: Bark splitting. Figures slightly enlarged.

Growers sometimes prune affected trees heavily, and this procedure is often followed by the production of leaves which are normal in colour though, perhaps, smaller than on healthy trees. These leaves, however, may become mottled after a short period, and the trees receive a further pruning. Such successive, heavy prunings produce a harsh, stunted appearance in the tree. Nothing of value is accomplished by this pruning treatment.

No plant parasitic organism has been found associated with mottle leaf, and the precise cause of this disease is not known although, essentially, it must be regarded as being due to a deficiency of zinc. Such a deficiency could be caused either by lack of zinc in the soil or the inability of the tree to absorb the amount of zinc necessary for its normal growth. It is not surprising, therefore, that mottle leaf is associated with certain types of soil, and in general in this State this trouble is in evidence mainly on sandy soils. Young trees from a nursery on such soils may show mottle leaf symptoms to a slight extent when they are planted on the heavier types of soil, such as the basaltic loams, but the trouble does not persist for many months, and no remedial measures are called for in such cases.

Control.

This deficiency disease can be controlled by applying zinc to the leaves of the trees in the form of a spray, the formula being 4 lb. of zinc sulphate and 2 lb. of hydrated lime in 40 gallons of water. The zinc sulphate is dissolved in one half of the water in the spray vat, and the hydrated lime, mixed with a little water, is slowly poured in while the vat is being filled with the balance of the water; the contents of the vat should be stirred briskly during the whole mixing process. For slightly-affected trees, the strength of the spray may be reduced to half the above quantities of zinc sulphate and hydrated lime. The usual time of application is at the flush of young growth in the spring so that the zinc spray may be combined with the routine application of cuprous oxide mixture for disease control at the $\frac{1}{2}$ to $\frac{3}{4}$ petal-fall stage. In districts where fumigation is used for insect-pest control, a zinc sulphate spray in which caustic soda is substituted for hydrated lime at the rate of $4\frac{1}{2}$ oz. of caustic soda for each pound of zinc sulphate is recommended for combination with the copper mixture to avoid possible injury by fumigation.

EXANTHEMA.

Trees affected by exanthema (Plate 171) commonly produce abnormally large, dark-green leaves, which often convey, to a casual observer, an impression of particularly good health. Closer examination, however, reveals the fact that such trees carry an unusually high proportion of dead twigs; in the worst affected cases, of course, it is obvious that die back of the twigs is the dominant characteristic of wood more than a few months old. A careful examination of affected trees shows that the twig growth is so bunched that, instead of two or three twigs arising close together, six or more such shoots have originated near each other and, as a consequence, each is spindly and angular. This angularity persists, and there is an absence of the evenly-rounded twig growth which characterises a healthy citrus tree. Furthermore, small, raised, blister-like patches which split lengthwise may be found on the surface of some of the young twigs. A resinous, brown gum is pushed out along the edges of these cracks and produces an appearance somewhat similar to proud flesh in animal wounds. An additional symptom which is not always found, but which, when present, is very conspicuous, is a cluster of many closely-packed, malformed buds in the leaf axils instead of the two that are normally present.

As is the case with mottle leaf, no organism has been found to which exanthema can be attributed, and it seems that the primary cause of this trouble is a lack of copper in the tree. As with other elements this deficiency may be brought about by there being an insufficient quantity of the element in the soil or by the inability of the plant to absorb the material, even though an ample supply is present. For the most part the latter explanation seems to be the one that is generally applicable in Queensland. At all events, soil conditions which tend to inhibit the uptake of plant foods are commonly associated with the occurrence of exanthema in this State. Thus faulty drainage and a hard pan close to the surface of the soil are very frequently found to be factors contributing to the incidence of the trouble.

Control.

If permanent results are to be obtained in the control of exanthema it is essential that any contributory adverse soil condition be remedied. In the first place, the physical condition of the soil should be examined

and, if necessary, improved by whatever appropriate action is practicable. Following this, fertilizer applications should be made, bearing in mind the fact that, whilst fairly liberal applications should be given, it is not advisable to be over-generous with nitrogen; the best practice is to provide the nitrogen in a number of light dressings at long intervals. Then, to rehabilitate an exanthema-affected tree, the bunched twigs must be thinned out and the dead wood removed; the gum-filled cracks on the twigs are sloughed off later as the tree makes healthy growth and thus require no further attention.

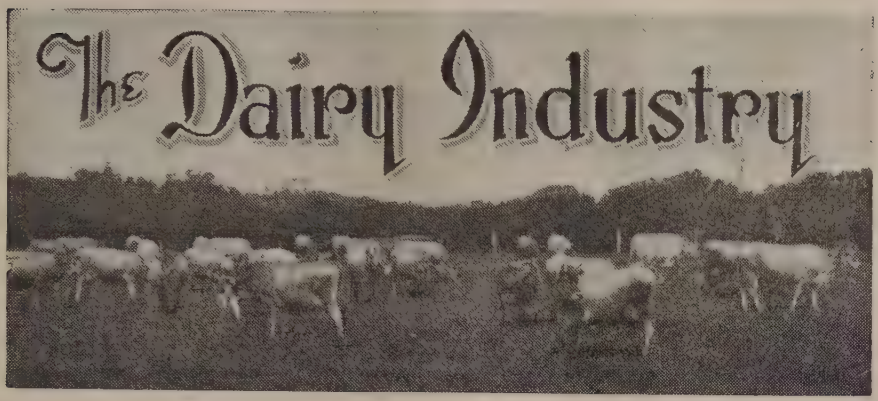
It has been found that exanthema may be quickly cured by treating an affected tree with copper. This may be accomplished by spraying the tree with cuprous oxide mixture, using the spray at a strength of 3 gallons of stock solution to 40 gallons of water. The routine citrus disease control sprays are sufficient for this purpose, or, if these are not ordinarily applied, then an application could be made in the spring when the fruit has been set, and repeated later if necessary. An alternative method, which is not considered to be quite so satisfactory, is to treat the soil by sprinkling fine bluestone crystals, i.e., copper sulphate, on the ground under the tree at the rate of 1 to 4 lb. per tree, the actual rate depending on the size of the tree, and then chipping it in. The recommended rate of application of copper sulphate should not be exceeded, otherwise the root system may be injured. Results from these treatments should not be expected until at least twelve months after their application.

NITROGEN AND IRON DEFICIENCIES.

Trees suffering from a deficiency of nitrogen present a general unthrifty appearance and make comparatively little growth in response to favourable climatic conditions. The foliage on such trees is sparse and individual leaves are often reduced in size, but the most conspicuous symptom is the yellow leaf colour. There is no leaf mottling such as occurs in several other deficiency diseases. Certainly, the veins may be somewhat lighter in colour than the rest of the leaf, but this is not usually noticeable. When the trouble is due to lack of iron, the leaves are pale yellow and the veins remain green for a considerable time. This point enables the citrus grower to differentiate between nitrogen and iron deficiencies which, at times, are superficially alike in the very early stages. Even in extreme cases, trees lacking nitrogen may flower profusely and set a heavy crop of fruit. However, the fruit does not grow to normal size and usually only a very small proportion is marketable. The fruit tends to ripen early and may colour prematurely.

As far as nitrogen deficiency is concerned, a general remedial measure is the application of a liberal ration of some nitrogenous fertilizer. Acute nitrogen deficiency, however, rarely occurs from a simple cause except in cases of neglect, and it is accordingly essential to ensure that, in addition to the nitrogen supply, soil conditions are otherwise suitable for the growing of citrus. No comprehensive recommendation can thus be made as to rates of application or form of fertilizer required to check nitrogen deficiency. Such recommendations will vary from case to case and can be determined only after an examination of the conditions under which the deficiency occurs.

Iron deficiency in Queensland is usually remedied quickly by applying up to 4 lb. of sulphate of iron to the soil under each affected tree. This procedure is not effective on certain types of soil, but no such soil type has yet been encountered in citrus orchards in this State.



Dairy Premises.

E. B. RICE, Director of Dairying.

THE fundamental factors involved in the planning, constructing, and equipping of dairy premises are—

1. Selection of site with due regard to aspect, drainage, and surroundings.
2. Provision of an adequate water supply for both dairy requirements and stock.
3. Giving due regard to—
   - (*a*) Good sanitation and hygiene.
   - (*b*) Good ventilation and lighting.
   - (*c*) Protection of quality of produce.
   - (*d*) Convenience of operation and economy of labour.
   - (*e*) Durability, service, cost.

It is generally appreciated that reasonable facilities, such as a weather-proof milking shed, wash-up and separating rooms and the essential equipment for the tasks incidental to milk and cream production, assist to relieve some of the tedium connected with the twice-daily milking-shed routine on a dairy farm. The design of modern dairy buildings and equipment is conducive to efficiency, sanitation, convenience and simplification of cleansing, and other procedure. However, it must always be remembered that the personal equation—that is, the will of the individual to do a job well—can outweigh every other factor and that good equipment can only facilitate the production of high quality dairy produce. Although quality is chiefly governed by the appreciation and application of the well-known principles of dairy hygiene, certain minimum structural and other requirements must be insisted upon for premises engaged in producing such perishable human foodstuffs as dairy produce. The standard buildings and other dairy facilities specified in the Dairy Produce Act, which cannot be regarded as unduly expensive or elaborate, essentially fulfil the structural and sanitary requirements.

Structural and Other Requirements.

The principal considerations in the erection of premises to ensure their compliance with the principles enunciated above are:—(*a*)

Suitability of site, (*b*) water supply, (*c*) drains and drainage, (*d*) floors, (*e*) wells and roof, (*f*) light and ventilation.

(*a*) *Site.*—The site of the main dairy buildings is of primary importance. If possible a well-drained position, not too far removed from the road and the farm residence, and on firm ground (preferably gravel) should be chosen. If available, a north or north-easterly sloping aspect is ideal, for it enables the shed to be built with its open end facing north or north-east, thus giving exposure of the floors to the germicidal rays of the sun for the maximum time each day. If the erection of the combined dairy building is contemplated, the separator room and verandah should, if possible, face east and the side wall of the separator room south. The site must have a slope away from the building to give effective drainage. The site for the piggery, if there is to be one, should be borne in mind when selecting the site for the dairy premises. The piggery should not be situated on a higher site than the milking yard otherwise contamination from drainage and storm rains must result. In addition, having the piggery down hill from the dairy buildings saves much effort. Wooden rails with trolley may then be used to convey separated milk to the pigs, or the skim-milk may be pumped from the separator room to the piggery by means of a milk pump and piping.*

Plate 172.
THE NECESSITY FOR AN ABUNDANT WATER SUPPLY IS RECOGNISED ON THIS FARM.

(*b*) *Water Supply.*—The availability of an abundant supply of water on every dairy farm, and especially in proximity to the dairy sheds, is of utmost importance. Unfortunately, water is not always easily available on Queensland farms, while in other cases the necessity for it to be laid on to the dairy is not always fully appreciated. The ideal is to have water available in all paddocks so that, to ensure maximum production, stock have access to it whenever they require it. How

* Where milking sheds have to be built on level ground, it is desirable to elevate the site before commencing to build. A few days spent with plough and scoop, or grader, raising the site for the shed and yards approximately 2 feet above the surrounding country is time well spent. The work should be done well before building operations commence to enable the foundations for the cement floor to become consolidated. If stock are allowed to trample the raised site this will shorten the period required.

often is water lacking in a night paddock? Thus the water supply is often a limiting factor in the quantity and quality of the milk or cream produced. Ample water is necessary for cooling purposes, washing and sterilising utensils and washing down of floors. It should be readily apparent that if creeks, wells or bores are not situated on the farm, it is impossible to conserve sufficient water in tanks from roof drainage to efficiently perform all the operations for which water is essential. Where ample water is available, its storage in elevated tanks adjacent to the dairy premises is most desirable. Such a supply gives the pressure so helpful in the washing down of floors, cooling, &c.

(*c*) *Drains and Drainage.*—Provision must be made for proper drainage if a serious menace to health and quality is to be avoided. A common failure is not extending the drainage system at least 30 feet away from the building—as specified in the Regulations. The drain, which should be without a sharp edge, should be wide enough to enable thorough sweeping out, and for dairy purposes need only be shallow. It should fall away from the dairy section of the building in order to discharge all drainage in the opposite direction outside the cow yard and be carried at least 30 feet away from the bails. Any drain which is likely to have traffic passing over it must be strong enough and so laid that it does not become damaged. Precautions should be taken to ensure that drainage does not run off to contaminate the water supply, a nearby watercourse, or the cow yard.

(*d*) *Floors.*—The Regulations specify the use of a non-absorbent material for all floors in dairy buildings. Other considerations in the selection of a flooring material are durability, sanitation, expense, and ease of cleaning. Concrete, which cannot be surpassed for Queensland conditions, is almost universally used. All floors must be graded to enable effective cleaning, the draining away of all moisture, and rapid drying off. Unless suitably reinforced, concrete floors will tend to "creep" on black soil, such as the Downs. Successful results have also been attained by placing a 3 inches layer of antbed under the concrete.*

Acknowledgment is made to the "G. & N. Co-operator" for the following hints on the preparation of concrete floors in dairy buildings:—

"The mixture recommended for concreting the floors of cow bails and yards is 4 cubic feet of screenings or gravel, graded from ½ inch up to 1½ inches and 2½ cubic feet of clean sand, graded from fine to ¼ inch, to each paperbag of cement (1 cubic foot), with only sufficient water to make a workable mix. This concrete, 3 to 4 inches in thickness, can be worked to a good non-slip finish without the necessity for a separate layer of sand cement mortar on the top.

"Level off the ground without disturbing unduly, but if the ground consists of clay, it is advisable to place a layer about 2 inches thick of sand or ashes before laying the concrete.

"After placing the concrete, screen off the surface with a straight-edge or long piece of timber, and leave the job for about two hours, then return to give the finishing touches with a wood float. Do just

* A common fault in the construction of concrete floors of milking sheds is to have the floor lower than the yard. If it be necessary to excavate the soil with a view to obtaining a firm foundation, it should be replaced with gravel or metal in order to ensure that the completed floor will be 8 to 12 inches above the surrounding area. This avoids flooding in wet weather.

sufficient work with this tool to obtain a moderately roughened sandstone texture, which will be smooth enough to sweep clean, and yet will not be slippery.

"To make a cubic yard of concrete of above mixture the following quantities of materials will be required:—6 bags of cement, 15 cubic feet of clean sand, 24 cubic feet of screenings or gravel (27 cubic feet, 1 cubic yard).

"A patch of this size to be put down 4 inches in thickness will cover an area of 9 square yards. It is advisable not to attempt slabs of more than 10 feet by 10 feet without joints. The slabs can be butted hard against each other.

"To make sure that the cow yards keep dry, it is advisable to have a slope from the centre to the sides (or, if desired, have the yard sloping all the one way), with a fall of not less than $\frac{1}{4}$ inch in 6 feet. By this method the drain need be placed around the outer edge only. To make the drain continuous with the concrete place a sloping piece of timber carefully in position to make out the direction and shape of the drain before pouring the concrete, and it will be found possible to shovel the concrete underneath the timber.

"Another very simple method is to spread the concrete and then squeeze down into it lengths of 4 inch pipes, which could be left in the concrete for about two hours, and then carefully removed.

"As regards the bails, not more than two bails should be placed as a continuous concrete slab; larger areas than this are likely to crack. The position of the drain is optional, but the best position seems to be inside the entrance to the bail near the cows' hoofs about 8 inches or 10 inches from the posts.

"Within 24 hours of placing, cover all concrete with wet bags, earth, sand, or waterproof paper, and keep wet for at least seven days. This is called curing, and is of the greatest importance in obtaining maximum strength."

(*e*) *Walls and Roofs.*—Dwarf concrete walls at least 18 inches, and preferably 3 feet, high at both ends of the bails and not less than 6 inches high elsewhere should be provided in all dairy structures to protect the wooden walls from constant dampness and eventual decay. Depending on the use to which a building is put the walls may be of concrete, brick, wood, fibro-cement, or galvanised iron. Interior walls of the dairy and separator room must be smooth and, from the sanitary standpoint, vertical boarding with tongued and grooved timber for the lining of dairy buildings is preferable. Fibro-cement is also very satisfactory for lining.*

(*f*) *Ventilation and Light.*—Sufficient light is usually available in buildings in this State. Indeed, precautions sometimes have to be taken to protect dairy produce from deterioration through exposure to direct

* Galvanised flat iron makes inexpensive and hygienic interior walls for the separator-room and aerator-room—the studs require to be placed to suit the size of iron sheets used and kept on the outside of the room. The minimum height for walls of the milking shed is 7 feet, and for the detached dairy house 8 feet.

Corrugated galvanised iron or corrugated fibro-cement are usually used for roofing. Because of its coolness, the latter is preferable for the main dairy buildings. Similarly, a hip roof provides cooler conditions than a flat roof; the ceiling should follow the contour of the roof.

sunlight. Windows in the dairy house must be so placed or shielded as to keep the sun's rays from shining on milk or cream. The separating room, wash-up room, and milk or cream storage room must be well ventilated to provide coolness. The regulations specify the requisite means for ensuring ventilation in the different buildings.

The separator room must be made flyproof. Although the dairy house (A) is not fly proof, it is found to be virtually fly free; in any case, cream stored therein is protected from flies by fitting to each can a flyproof, brass-woven wire of No. 12 mesh and No. 24 gauge, or other approved material, attached to a metal rim.

Plate 173.

A CLEAN, WELL-MADE YARD MEANS CLEAN COWS AND MANURE CAN EASILY BE COLLECTED FROM IT FOR DISTRIBUTION ON THE LAND.

Assembly or Cowyard.

A strong and roomy yard for assembling the cows before milking is indispensable. It is usually constructed of posts and rails, at least 4 ft. 3 in. to 4 ft. 6 in. high, the rails being of 5 inches by 3 inches hardwood or bush or other timber of equivalent strength. The yard must be large enough to hold all the cows in the herd. It should be on a well-drained piece of land with the slope away from the milking shed and dairy and preferably having a northerly or north-easterly aspect. Gravelling is advisable, but in some soils may not be entirely successful. In such cases, or in wet coastal areas, a smaller holding yard, into which a few cattle may be drafted at a time from the larger yard, is recommended. The concreting of this small yard ensures much greater comfort in wet weather and reduces dust in the shed. This concrete should not be finished to a very smooth surface. In heavy rainfall districts the building of a roof over this small concreted yard is suggested; the roof must be high.

The placing of the holding yard on the end, instead of in front, of the bails is being increasingly adopted with a view to the abatement of the dust in the shed and dairy. A further advantage of a side assembly yard is that it enables the shed to be adapted for carrying out all dairy operations, including milk or cream storage, under a single roof. In this type of layout the provision of a strip of concrete about 6 feet wide in front of the bails will facilitate the handling of the herd during milking.

It is important that the cowyard fence nearest the dairy end of the shed be projected from the first bail, thus excluding the dairy end of the shed from the cowyard.

Milking Shed, Dairy Houses, &c.

Milking Sheds.—For Queensland climatic conditions, elaborate buildings are unnecessary as dairy cows are never housed indoors. The milking shed is only to afford the milkers protection from the weather. Nevertheless, conditions can be most unpleasant in hot, cold, or rainy weather if the shed has the wrong aspect or is ill-designed. As previously stated, the open end of the shed should, if possible, face north or north-east. Materials usually used are weatherboard for walls and galvanised iron or corrugated fibrolite for the roof. The height of walls must be at least 7 feet.

Plate 174.

SOUNDLY CONSTRUCTED "WALK-THROUGH" BAILS.—Note the dummy bails suspended from roof.

Milking bails commonly found in this State may be classified as—

1. New Zealand walk-through bails (double bail type);
2. New Zealand walk-through bails (single bail type);
3. Return bail type;
4. "Sword" bails;
5. Crush bails.

Bails of the "walk-through" type (Plate 174) are in most popular demand and in recent years have almost entirely displaced

all other designs, except for town dairies engaging in hand-feeding of stock. Their popularity is due to the fact that hand-feeding is practically unknown on most Queensland farms supplying butter and cheese factories. If hand-feeding is resorted to in drought periods it is usually carried out in temporary feeding stalls. The suspended type of dummy bails (well strengthened) facilitates cleaning.

The advantages of the "walk-through" system are—(*a*) by the milked cows going straight out to the grazing paddocks the grazing periods are lengthened; (*b*) the milked and unmilked cows do not become mixed in the assembly yard and so congestion is avoided and time saved; and (*c*) the backing out of the shed of the milked cows, with danger of accident from slipping, is eliminated.

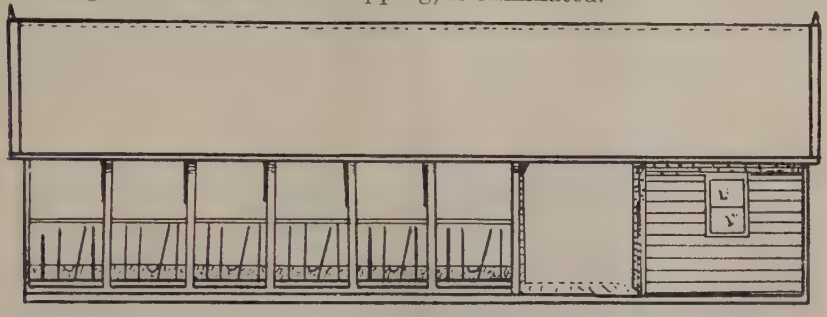


Plate 175.
"RETURN" TYPE BAIL.

When milk for human consumption is produced on farms adjacent to towns, hand-feeding is often a regular practice and the "return" bail shed (Plate 175), in which hand-feeding is facilitated, is commonly preferred. However, walk-through bails are now being more extensively used on these farms, the feeding being carried out in a separate shed.

Attempts to provide more comfortable conditions in milking sheds are now receiving more attention. Many sheds are unbearably hot in the summer. The milking shed is very rarely ceiled, although favourable reports on their coolness of the few ceiled sheds known to dairy officers have been received. Large openings fitted with shutters at each end of the bails provide coolness. A door, opening inwards, between each dummy bail, which may be left open on hot days, tends to reduce the heat. Such a door is more suitable than fixed louvres as, unlike the louvres, it can be shut in cold weather.

Dairy Houses.

Dairy House "A" (Plate 176).

A detached dairy house at least 30 feet away from the cowyard, in which to store cream, is required for cream-supplying farms, unless the combined building, referred to later, is provided. Its minimum dimensions are 8 feet long by 6 feet wide by 6 feet high. The ceiling should preferably follow the contour of the roof. In conjunction with this dairy house a place for the cleansing of utensils is to be provided. This may be a veranda 8 feet long by 5 feet wide by 6 feet 6 inches high or a Dairy House "B." It is recommended that a veranda be

attached to Dairy House "A" and that it be made somewhat wider than the minimum of 5 feet prescribed by the Regulations—say, 6 feet 6 inches. The veranda may, if desired, be extended to cover two or more sides of the dairy. The dairy must have a dwarf concrete wall of at least 6 inches high by 3 inches thick, to which a hardwood plate may be affixed as a base for the walls. Besides sloping the floor and providing a 30-feet drain, other requirements of the Regulations are—

(*a*) The provision of ventilation by means of 16-inch-wide openings at the top of all walls, protected by a 19-gauge woven wire or wire netting of ¼-inch or ½-inch mesh;

(*b*) The provision of two openings, not less than 9 inches wide and extending at least two-thirds of their length in two opposite bottom walls (not the veranda wall), galvanised iron woven wire, No. 18 gauge and ¼-inch mesh, protects these openings, which must also be shaded in an approved manner;

(*c*) The dairy must be lined and ceiled.

Plate 176.

REGULATION DAIRY HOUSE "A" WITH VERANDA FOR WASHING AND STORAGE OF UTENSILS.

The veranda or Dairy House "B," as the case may be, accommodates—

1. The separator (on hand-milking dairies);
2. A wash-up trough not less than 34 inches long by 20 inches wide by 11 inches deep, fitted with a draining plug;
3. A draining rack not less than 16 inches wide of galvanised iron piping or other approved material for the drying of utensils, &c.

In the case of a dairy operating a milking machine, separation may be done in a room adjacent to the milking shed, providing—(*a*) The room is ceiled; (*b*) All openings, including windows, are

protected by 16-mesh, flyproof, rustless wire gauge; (*c*) The doors are self-closing; (*d*) The floor is impervious to water, sloped, and drained; (*e*) The walls are smooth and the roof waterproof; (*f*) A walled air space of at least 6 feet is left between this room and the nearest bail. This space may be, and usually is, used to house the engine and vacuum pump of the milking machine. The engine may be protected from inclement weather by fixing louvres in the far end of the air space, the overhang of the shed roofing giving sufficient protection to the end facing the cowyard. The separator-room should be at least 10 feet square, thus enabling the milk vat to be placed approximately 2 feet from the wall. The lining of the wall near the milk vat with flat sheet iron, painted white, is suggested as a means for controlling mould growth on the portions of the walls adjacent to the milk vat. This reduces the unsightly mould growth so common in a small separating-room.

Plate 177.
DAIRY HOUSE "B" ON A FARM SUPPLYING MILK TO A CHEESE FACTORY.

Dairy House "B."

On farms supplying milk to a cheese factory, or for local consumption, Dairy House "B" (Plates 177, 178) may be used in lieu of the Dairy House "A." Its minimum dimensions are 6 feet long by 6 feet wide by 7 feet high, but it is recommended that it be made at least 8 feet long. The wash-up trough and draining rack already described are placed in Dairy House "B." The cooling and aeration of milk is also carried out in this room.

Covered Milk Stand.

Milk kept on the farm overnight for supply to cheese factories must be placed in a covered milk stand not less than 4 feet wide by 4 feet long by 4 feet high, and the floor of which is 3 feet from the ground. The roof must have an overhang to protect the milk from the weather and the eastern side of the stand must be louvred to protect the cans from the sun's rays in the morning. A trolley on

rails connecting the milking shed and the milk stand minimises the work involved in removing the filled milk cans to the milk stand.

Plate 178.

DAIRY HOUSE "B" CONSTRUCTED TO SERVE ALSO FOR HOLDING MILK OVERNIGHT.—Note attached galley to house steam steriliser.

On a milk-supplying farm using milking machines, a room adjacent to the milking shed may be used for cooling and aerating the milk, but it must be kept in the covered milk stand overnight.

Roadside Cream Shelter.—For the protection of cream placed at the farm entrance in readiness to be picked up by the cream lorry a roadside cream shelter should be provided. It need not be expensive; indeed, sufficient material for its construction is usually available on a farm. The floor of the shelter should be not less than 3 feet 6 inches, and not over 3 feet 9 inches, from the ground and the floor area must be sufficient to hold the maximum number of cans of cream produced. Unless louvred, the shelter will be too hot in summer and cream stored therein liable to suffer deterioration.

Suggested Layout for Small Hand-milking Farm.

For small farms on which hand-milking is employed a serviceable layout of dairy buildings would be—(*a*) Milking shed of desired type; (*b*) Detached Dairy House "A" with veranda for separating and washing up in the case of cream suppliers, or Dairy House "B" and covered milk stand in the case of cheese factory suppliers. This layout (Plate 10) is the most inexpensive. It entails the erection of a milking shed to be used for milking only, without any other room attached thereto and the performance of all other operations in the dairy situated 30 feet away. The layout, by necessitating the removal of the milk from the vicinity of the cow shed as soon as it is produced, and keeping it, or the cream separated therefrom, and all utensils away from the bails and cowyard, minimises contamination from dust and absorption of cowyard odours. It is advisable to have the veranda on the western side of the Dairy "A" to protect the cream from the sun's rays in the afternoon.

[TO BE CONTINUED.]

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which have qualified for entry into the Advanced Register of the Herd Books of Australian Illawarra Shorthorn and Jersey Societies. Production records for which have been compiled during the month of April, 1944 (273 days unless otherwise stated).

Name.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (STANDARD 350 LB.).				
Cedar Grove Madam 5th	W. H. Sanderson, Mulgeldie	18,598·52	680·716	Cedar Grove Umpire
Model 2nd of Alfa Vale	W. H. Thompson, Nanango	13,503·15	663·182	Reward of Fairfield
Jamberoo Reddy 5th (365 days)	M. J. Brosnan, Clifton	18,383·4	656·976	Brooklyn Terrace Banker
Queenie 19th of Greyleigh	W. H. Thompson, Nanango	13,831·95	519·262	Thornleigh Champagne
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Jamberoo Modesty 11th (365 days)	M. J. Brosnan, Clifton	17,158·3	638·557	Greyleigh Valiant
JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Bingleigh Ethel	J. C. Meier, Grandchester	8,954·75	340·447	Blacklands Count
Happy Hill Leila	R. R. Radel, Coalstoun Lakes	6,929·99	281·378	Sunnyview Artist
SENIOR, 2 YEARS (STANDARD 250 LB.).				
Jamberoo Winnie 4th (365 days)	M. J. Brosnan, Clifton	13,682·1	529·245	Greyleigh Valiant
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Bingleigh Ruby	J. C. Meier, Grandchester	10,757·11	434·308	Blacklands Emblem
Jamberoo Marjorie 8th (365 days)	M. J. Brosnan, Clifton	10,250·9	387·357	Greyleigh Valient
Silver Glen Princess	V. R. Nugent, Murgon	10,726·15	371·431	Aynsley Renell
Jamberoo Gracie 2nd	M. J. Brosnan, Clifton	8,323·15	331·192	Greyleigh Valiant
Bingleigh Miss Jean 2nd	J. C. Meier, Grandchester	8,028·17	319·145	Blacklands Emblem
Edendell Jeanette	A. Manderson, Gleneagle	6,173·65	289·262	Dnalwon Penrose
JERSEY.				
MATURE COW (STANDARD 350 LB.).				
Trecarne Safety 2nd	P. H. Schull, Oakey	7,584·75	407·667	Trinity Some Officer
JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Boree Pearlie	W. and C. E. Tudor, Branch Creek	7,842·06	400·979	Boree Soldier Boy
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Boree Beauty	W. and C. E. Tudor, Branch Creek	8,292·22	380·571	Boree Soldier Boy
JUNIOR, 3 YEARS (STANDARD 270 LB.)				
Bellgarth Fashion 2nd	D. R. Hutton, Cunningham	7,761·94	386·003	Trecarne Renown 2nd
JUNIOR, 2 YEARS (STANDARD 230 LB.).				
Bellgarth Goldie	D. R. Hutton, Cunningham	5,062·85	252·742	Trecarne Victor 2nd

Egg Production.

P. RUMBALL.

THE egg production objective for the controlled area of Queensland for the year ending June, 1944, has been fixed at 8,000,000 dozen. It is estimated that production will fall short of this objective by about 500,000 dozen. The lag in production may be ascribed to several causes, none of which was probably avoidable, particularly by the individual producer. The objective for the 1944-45 year has been fixed at 8,500,000 dozen eggs, which many producers say cannot be attained. It can if everyone engaged in egg production gives of his best.

A good start has been made. Many thousands more chickens have been hatched during the first six months of this year than in any previous year. The excess of hatching during this period over previous figures may approach 250,000 chickens. Many chickens have already been despatched to places beyond the area of control, but a big proportion of the season's hatches has been retained within the area. Reports of hatching for the second half of the year indicate that a record hatching will again be made. Many of these chickens will come into production before June, 1945, and so assist in attaining the objective for that year.

The right start has been made and it now remains for producers to bring about the increased production aimed at. It may be thought by many that the reaching of the goal is of no immediate concern to them. This is not so. Every person engaged in poultry raising should seriously concern himself with the supply of eggs. The acute shortage of eggs will, no doubt, cause a large number of people to commence the keeping of poultry for home requirements; others, again, may refrain from using eggs, so when the position returns to normal poultry raisers may be scratching for markets. This may be considered a very good reason why the industry should not be expanded. The production objective set, however, is not much beyond the pre-war aggregate, most of which was sold on local markets. If householders are forced to produce their own eggs, and others become more or less habituated to doing without eggs, when conditions return to normal the local market may be adversely affected to a serious extent. Producers may not commonly be aware of the fact that for years past sales of eggs on the local market have increased year by year. This has not merely been because of any increase in population, but to the fact that an assured egg supply has removed the necessity of householders producing for their own domestic requirements.

Again, for years after the last war, no difficulty was experienced in handling any surplus. Overseas markets were available; in fact, export outlets gave marketing organisations the means of stabilising their operations, thus enabling the industry to be built up to the existing standard. There is every prospect of overseas markets absorbing any surplus for years after the present war.

In an effort to increase production by increasing the size of the flocks, farmers have had to face many difficulties chiefly because of the shortage of wire netting, building material, and equipment. The netting position has somewhat improved, and poultry raisers are now able also to obtain fibro cement, both corrugated and plain. The equipment position is still difficult, but the increase in the number of poultry houses erected in the course of the past year should permit of the housing of sufficient birds to make a material contribution to production, if every individual producer does his part.

In past years, poultry raisers have been advised to refrain from early hatching, as the chickens come into production during that period of the year when the egg supply is plentiful and values are low. There is, however, every reason to believe that values during the coming spring will at least be as high as during last spring. If this happens, the retention of the early hatched pullets for egg production should be highly profitable; and although many have been raised to meet the demand for table purposes, the keeping of these birds for egg production at least until they commence to moult will go far in assisting in the attainment of the production objective. In previous years, it has been the custom for many to commence disposing of large numbers of second-year hens early in spring. When egg values were low this was a sound practice. The withholding from the market of this class until the birds commence to moult should also materially assist in achieving the goal set, and only delay the quantity of table poultry to be marketed. This policy may also prove a very profitable venture, as hatching commenced much earlier this year than in previous years. More cockerels are now being reared than is usually the practice, and the delay in marketing unwanted hens will prevent the possibility of the table poultry market becoming over supplied.

To enable the maximum production to be obtained, good husbandry practices are essential. As many of the chickens hatched will go to mixed farms, and as much of the Queensland production comes from this source, the following points in poultry husbandry are stressed.

Stock.

As a rule, farmers engaged in general agriculture give little attention to breeding poultry. Farm duties are too numerous to attend to the detail necessary for the work. The broody hen is usually the hatching medium for the replacement of the farm flock. The invariable result is a hatch of indifferent quality. Therefore, the best plan for the general farmer to adopt is to buy day-old chickens from some reliable hatchery.

Kind of Chickens.

Either pullet day-old chickens, or day-old chickens of which the sex has not been determined, may be obtained. Although the term "pullet day-old chickens" is given to chickens which a licensed person claims to be pullet chickens, there may be cockerels among them. Usually one

can expect in every 100 pullet day-old chickens about five cockerel chickens. Cockerel day-old chickens may be easily identified by farmers, for after the sex has been determined they are sprayed with a purple stain. This error varies a little either way, but 5 per cent. may be taken as an average. Among day-old chickens of which the sex has not been previously determined usually 50 per cent. of either sex will be found.

Culling.

All chickens reared may not be satisfactory producers. Weedy and poorly grown birds are not worth keeping for production and should be disposed of as early as possible. Some culling should be practised during the early stages of production, and again at the end of the first year's production. In fact, where the flock is of sufficient size, culling should be done from day to day.

Rearing Young Chickens.

Rearing chickens is not difficult. If only a few chickens, say 50, are bought, they can be brooded without any elaborate equipment; but if bought in batches of hundreds brooders are most desirable. It is considered that a farmer would be better served by buying a brooder than by making use of home-made contrivances, as it is little use buying expensive chickens to lose them by a saving of a pound or so on a brooder. Notes on brooding may be obtained on application from the Department of Agriculture and Stock.

Feeding.

Feeding Chickens.—To ensure the best development, correct feeding is necessary. For the first eight weeks, a ration having a protein level of from 18 to 20 per cent. is most desirable. Suitable rations may be purchased. They may, at first sight, appear costly, but the chicken eats very little during this period, consequently the added cost of proper feeding is not too much, and it is most essential to give the chicken a good start in life. Later, cheaper foods can be used. To illustrate the small food consumption per 100 chickens, the following table is given:—

FOOD CONSUMED PER 100 CHICKENS.

	Leghorns.	Australorps.
	Lb.	Lb.
First four weeks	40	45
First eight weeks	340	400

Feeding Laying Stock.—Layers are generally fed on mash and grain. However, satisfactory production may be obtained when layers are fed grain only and have skim milk to drink. One gallon of skim milk to each 20 fowls will supply all the protein of animal origin that the birds require. Farmers supplying particulars of the foodstuffs available can be advised as to how it should be fed, and what additional foodstuffs that should be procured to be fed in combination with the home-grown product. The preparation on the farm of a mash may become a problem too big for the small egg producer, and he may find it more convenient to buy a prepared mash.

Marketing.

Eggs are the principal product that the poultry raiser has for market. With the small producer the biggest fault is to accumulate supplies until case lots are obtained, consequently by the time of market delivery, eggs will have depreciated greatly in quality, resulting in much lower values for a large proportion of the consignment. To realise highest values, eggs should be marketed at least twice a week. Where the farmer has not enough eggs to make up case lots, it would be advisable for him to link up with a neighbour in forwarding composite consignments. Each contributor to any composite consignment to the Egg Board is paid by the Board for his own eggs directly, and, under such conditions, an equitable distribution of incidental charges may be arranged.

SALT FOR STOCK.

The Minister for Agriculture and Stock (Mr. T. L. Williams) has announced that many graziers were urging the release of salt and other lick ingredients for sheep in the drought-affected areas.

Mr. Williams pointed out that most bore waters contained salt and that frequently sheep obtained more than was sufficient in their drinking water for their well-being. It was then obviously unnecessary and wasteful to provide further salt.

The salinity of waters could be determined accurately only by analysis, and he had arranged with the Agricultural Chemist of his Department to analyse all samples of water, whether from graziers or farmers, free of charge.

Mr. Williams further announced that he would make the full-time services of Dr. Montgomery White available for the purpose of advising graziers on the most economical and satisfactory manner of conducting their feeding programmes.

Plate 179.
INSECTIVOROUS GULLS IN ACTION.

GADGETS AND WRINKLES

TANK MEASUREMENTS

TANKS WITH IRREGULAR SIDES.

EXAMPLE 8.

Add together length at top of both sides and divide by 2 for mean top length.

Add together length of both ends at top and divide by 2 for mean top width.

Add together length at bottom of both sides and divide by 2 for mean bottom length.

Add together length of both ends at bottom and divide by 2 for mean bottom width.

Multiply mean top length by mean top width.

Multiply mean bottom length by mean bottom width.

Multiply sum of top and bottom mean length by sum of top and bottom mean breadth; add these three last results together; multiply by depth; divide by 6 for cubic feet, and the result by 27 for cubic yards.

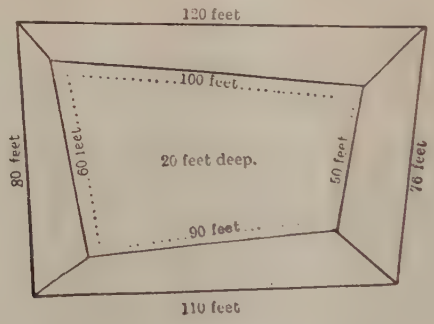


Plate 180.

Top	$120 + 110 = 230 \div 2 = 115$	Top
	$80 + 76 = 156 \div 2 = 78$	
Bottom	$100 + 90 = 190 \div 2 = 95$	Bottom
	$60 + 50 = 110 \div 2 = 55$	
Top Area	$= 115 \times 78 = 8970$	
Bottom Area	$= 95 \times 55 = 5225$	
	$210 \times 133 = 27930$	
	42125	
	20 ft. deep	
	6)842500	
27	3)140416⅔	cubic feet
	9) 46805-1	
	5200-5	16⅔

Contents = 5200 cubic yards 16⅔ cubic feet.

Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

BABY'S MILESTONES (PART II.).

Learning to Talk.

A COMMAND of one's mother tongue is a necessary foundation for a liberal education. Whatever our lot in life it is a distinct advantage to be able to express thoughts and emotions in a fluent attractive way, and for this reason most parents would wish their children to have this accomplishment, for they are responsible for their children's ability to talk well or otherwise.

A baby begins practising talking very early in life. He finds that it is fun to make noises and experiments for the sake of the pleasure he gets out of it. Actually a baby of six months experiments and practises with very many more sounds than he will ever use when he finally settles down to real talking.

The important thing which parents should realize is that a baby understands words long before he forms and uses them. He may show that he does so by kicking or cooing when his feeding time is mentioned, or pointing when asked where is little brother or the puppy. But whether he does this or not, it should be remembered that he is shaping his language according to the model his parents and brothers and sisters are presenting to him. A baby can only repeat what he hears, and if the sounds he hears are badly formed and carelessly spoken words, slang or swearing, the day will come when, like a gramophone record, he will reproduce these sounds.

It is only by constant painstaking effort that faults of speech and pronunciation can be corrected once they have become fixed during a child's pre-school years, and so it is the manifest duty of every parent (and those who have their children's welfare at heart will realize this) to improve their own speech, *inflections and idioms* so that the children in their turn will speak correctly and attractively.

There may be a period in his school days when a boy who has been taught to speak correctly thinks it is manly to speak roughly and use slang expressions, but that will pass and he will revert to the type of speech he learnt in his home training.

Learning to associate words with things and situations will usually proceed slowly or quickly, according to the opportunities provided by the mother or guardian who is with the child all day. A silent mother makes a silent baby, while a mother who is a good commentator on life helps her child to understand it. At eleven to twelve months old, the average child says single words, and by two years he is usually able to make these words into short sentences.

If a child is not talking by that age, it is a good plan to have the child examined by a doctor. If he has been having regular "check-ups" at a Child Welfare Centre, his progress will have been carefully noted and any defects referred to the appropriate quarter for correction, but if not it is advisable to ask a doctor what he thinks. Children may not try to talk at the right time from laziness, some degree of deafness,

or bad management in the home causing the child to become bewildered, resentful and what is known as negative. The earlier speech defects are taken in hand, the sooner will they respond to treatment; so parents should not hesitate to obtain expert advice on this important point.

Questions on this or any other matter concerning Maternal and Child Welfare will be answered by communicating personally with the *Maternal and Child Welfare Information Bureau*, 184 St. Paul's terrace, Brisbane, or by addressing letters *"Baby Clinic, Brisbane."* These letters need not be stamped.

SOUPS.

The best base for soup is lean and uncooked meat in the proportion of a pound to a quart of water. Meatbones well broken up and added lend a very delicate flavour. A combination of meats, such as beef, mutton, veal, and ham-bones, will make a higher-flavoured soup than any one meat. It is well to remember that it is the meat and bones from the legs that are rich in gelatine, and these should be purchased in preference to all others for soup making. Soup should have merely the flavour of salt, and there should be in it the warm tone which the judicious use of pepper gives. Other flavourings are sage, thyme, mint, parsley, bay leaves, mace, cloves, celery seed, and onions.

Ten-minute Soup.

Take 2 oz. butter, 2 oz. flour, 2½ pints milk and water or milk and white stock, 3 or 4 tablespoonfuls tomato sauce, seasoning.

Melt the butter, add the flour, and mix them until well blended. Stir in the milk and water or stock and stir until the soup boils and thickens. Let it boil gently for a few minutes, then add tomato ketchup and seasoning to taste. If liked, a few drops of cochineal may be added to improve the colour of the soup. If too thick, thin the soup down with a little more liquid. This makes an excellent emergency soup.

Tomato Soup.

Take 2 lb. tomatoes, 2 pints water, 1 oz. butter, a few celery seeds or a small piece of celery, 1 carrot, 2 onions, cornflour, salt and pepper, sugar, 1 clove garlic.

Prepare the carrot and onion and cut them in slices. Melt the butter and cook the vegetables in it for a few minutes without letting them brown, then draw the pan aside and add the tomatoes cut in slices, the water, garlic, and celery. If using celery seeds tie them in muslin. Cook the vegetables until tender, then remove the garlic and celery seeds, and rub the soup through a sieve. Return it to the pan, season with salt and pepper, and a little sugar if liked, and thicken it with a spoonful of cornflour mixed to a smooth paste with cold water. Boil the soup for a few minutes and serve it with croutons.

Mulligatawny Soup.

Take 1½ lb. scrag of mutton, 3 pints cold water, about 1½ oz. dripping, 2 carrots, 2 onions, 2 small apples, a few mixed herbs, a small piece lemon, 3 dessertspoonfuls flour, 2 teaspoonfuls curry powder, 2 or 3 dessertspoonfuls rice, seasoning.

Scrape, wash, and slice the carrots. Peel and slice the onions. Peel and quarter the apples and remove the core. Melt the dripping in a saucepan, add the carrot, onion, and apple, and fry until lightly browned. Stir in the flour and curry powder and fry again for a few minutes, then draw aside. Cut the mutton into small joints and add to the vegetables, with the water, herbs—tied in muslin—and seasoning to taste. Bring all slowly to the boil, remove the scum, and simmer for about two and a-half hours. Take out the meat and herbs and rub the soup through a sieve. Skim off any fat from the top, then reheat the soup. Squeeze in a little lemon juice and serve. Have ready the boiled rice and serve separately. If necessary, add a few drops of browning to the soup just before serving.

To prepare the rice, wash it well. Put it into a saucepan of boiling water, with a little salt added, and boil until tender—it will take about fifteen minutes. When cooked, strain it through a colander, pour cold water through it to separate the grains, then place on a dish in a warm oven to dry, and reheat.

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